# **Historic, Archive Document**

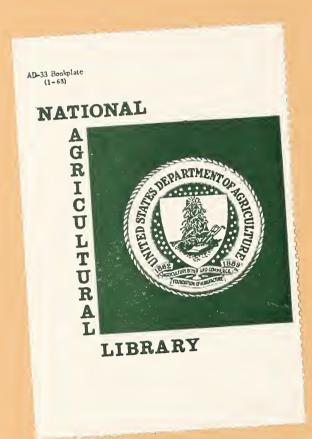
Do not assume content reflects current scientific knowledge, policies, or practices.



# GHEYENNE STAGE II WATER DIVERSION



ROCKY MOUNTAIN REGION
U.S.D.A. FOREST SERVICE



# DRAFT ENVIRONMENTAL IMPACT STATEMENT 02-06-80-02

Cheyenne Stage II Water Diversion Medicine Bow National Forest -Albany and Carbon Counties, Wyoming

Lead Agency:

USDA Forest Service 605 Skyline Drive

Laramie, Wyoming 82070

Cooperating Agencies:

USDT - Fish and Wildlife Service

USDI - Bureau of Land Management

Department of Defense - Corps of Army Engineers

Wyoming Game and Fish Department

Responsible Official:

Craig W. Rupp Regional Forester Rocky Mountain Region

11177 W 8th Ave., Box 25127 Lakewood, Colorado 80225

For further

information contact:

Don M. Bolinger Project Coordinator

Medicine Bow National Forest

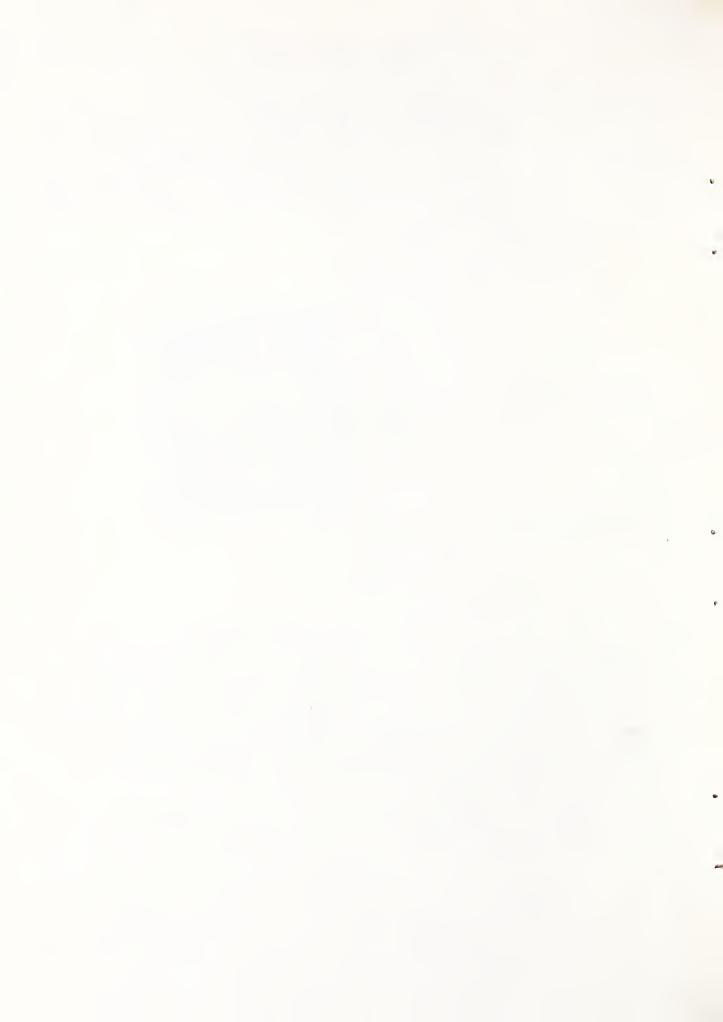
605 Skyline Drive

Laramie, Wyoming 82070

(307) 745-8971, Ext. 102

Abstract: The Cheyenne Board of Public Utilities has submitted a Statement of Need and application to expand its water collection system. This proposal, called Stage II, would expand the collection area in the Sierra Madre Mountains southwest of Encampment, Wyoming; increase the capacity of Hog Park and Rob Roy Reservoirs; collect water out of Douglas Creek and Lake Creek drainages near Keystone, Wyoming, and require the installation of pipe for collection and transmission of water. The decision needed is whether or not to issue a permit to the proponent for water development.

Comments on this draft must be received by the Medicine Bow National Forest before \_\_\_\_\_\_.



#### SUMMARY

### THE CHEYENNE STAGE II WATER DIVERSION PROPOSAL

02-06-80-02

#### ADMINISTRATIVE

# A. DESCRIPTION OF PROPOSED ACTION

This Environmental Impact Statement evaluates the issues, concerns, and effects involved, with the need to decide whether Federal permits should be issued to the Cheyenne Board of Public Utilities for development of a transbasin water diversion. The proposal would involve the Sierra Madre Mountain Range, southwest of Encampment Wyoming; the Medicine Bow Mountains, west of Laramie Wyoming; and Pole Mountain, east of Laramie Wyoming. These areas of the Medicine Bow National Forest are located in Carbon and Albany Counties, Wyoming.

The "Cheyenne Stage II Water Diversion Proposal" Environmental Impact Statement will document the basis for deciding whether or not to issue Federal permits. It will also document conditions that would be a part of the permits.

The proposal being evaluated involves the transmission of up to 27,500 acre-feet of water from the Little Snake River drainage, a portion of the Colorado River Basin, across the Continental Divide into the North Platte River drainage. This water would be used as replacement water for up to 27,500 acre-feet of water which would be taken from Douglas Creek in the North Platte River Basin and transported to Cheyenne, Wyoming through a pipeline and Middle Crow Creek.

The proposal involves the installation of up to 90 miles of pipeline ranging in size from 18 to 72 inches in diameter; up to 36.1 miles of new access roads; increasing the size of Rob Roy and Hog Park Reservoirs to 800 and 695 acres respectively; and the installation of up to 30 diversion structures on the tributaries in the Little Snake River and Douglas Creek area.

Population growth in many smaller communities within the affected area could place additional demands on water supplies. Some of the small communities get water from the same source as in the proposal. This document records a recommended course of action that will best resolve the issues and concerns involved with the proposal.

# B. ALTERNATIVES CONSIDERED

Alternatives studied in detail:

Alternative A: NO ACTION - All current situations would remain as is. There would be no expansion of the current Cheyenne water gathering system (Stage II). Cheyenne would have to utilize other water sources.

Alternative B: PERMIT PROPOSED FACILITIES WITH MODIFICATION - This proposal would allow full development of the Cheyenne proposal with modification to mitigate adverse impacts on the forest and human environments.

Alternative C: MODIFY STAGE I COLLECTION SYSTEM TO INCREASE CAPACITY AND EXTEND THE PROPOSED SYSTEM TO THE VICINITY OF WEST BRANCH OF THE NORTH FORK OF THE LITTLE SNAKE RIVER. - This alternative would require that the current system be modified or enlarged to gather the available water that now passes by the system during high runoff. The new collection system would stop at Standard Creek in the West Branch of the North Fork of the Little Snake River drainage.

Alternative D: CONSTRUCT A RESERVOIR LOWER IN THE NORTH OR MIDDLE FORK BRANCHES OF THE LITTLE SNAKE RIVER AND PUMP WATER INTO THE EXISTING SYSTEM. - This alternative would allow water in the Little Snake River tributaries to flow unobstructed in natural channels to this lower reservoir. The water would then be pumped back uphill to Hog Park Reservoir where it would be released into the North Platte River System.

Alternative E: PUMP FROM HOG PARK RESERVOIR TO ROB ROY RESERVOIR - This alternative would involve the development of the full collection system in the Little Snake River drainage, but the water would be pumped directly to Rob Roy Reservoir and on to Cheyenne instead of being used as replacement water.

Alternative F: PUMP FROM NORTH PLATTE RIVER AT BOAT CREEK CONFLUENCE TO ROB ROY RESERVOIR - The full collection system would be developed in the Little Snake River. The water would flow back into the North Platte system to replace water taken at the Boat Creek confluence, then be pumped to Rob Roy Reservoir, and on to Cheyenne.

Alternative G: PUMP FROM THE NORTH PLATTE RIVER NEAR NORTHGATE, COLORADO TO POLE MOUNTAIN - The full system would be developed in the Little Snake River drainage. The water would be used for replacement. Water would be pumped directly from the North Platte River to Pole Mountain, bypassing Rob Roy Reservoir.

# 750020

Other alternatives considered but eliminated from detailed study were; growth management, water recycling, weather and streamflow modification, purchase of wells in Laramie and Albany Counties, water conservation and rationing, and Cheyenne's proposal without mitigation. A full discussion of alternatives considered may be found in Section VII.

The following mitigation measures are considered necessary if one of the proposed construction alternatives is eventually selected:

- a. All Stage I and Stage II diverted streams would have a maintenance flow to insure that 100% of the fishery and riparian habitat is protected.
- b. Wildlife habitat loss mitigation measures would include fencing 100 acres of potential riparian habitat on Pole Mountain in the Green Mountain C & H Allotment. The fence would be constructed to keep livestock out of the stream bottom except where water gaps would allow livestock to drink and cross back and forth. Forage utilization would be improved as cattle would be forced to graze away from the stream bottom on areas presently receiving light use. Permitted livestock numbers would not be adversely affected on the Green Mountain C & H Allotment. (Fish and Wildlife Service Coordination Act Report Draft 1980).
- c. A water release system from Hog Park Reservoir must be devised to insure Hog Park Creek is protected and the wilderness character of the Encampment River is not altered.
- d. All diversion structures on major streams would be designed to allow a permanent unadjustable flow to bypass the structure at the rate specified for that stream.
- e. Rights-of-way would be feathered by selective removal of trees along edges to provide for a softening edge effect and blend with the landscape instead of having a straight line appearance.
- f. Roads, wherever possible, would be on the same location as the pipeline to reduce construction impacts on the resources.
- g. Re-establish any destroyed facilities such as campgrounds, existing access roads, and administrative sites.
- h. South Branch of Middle Crow Creek would be augumented by 3-5 cfs. The water that is not used for instream augmentation must be transported across Pole Mountain by some method other than allowing additional amounts to flow down Middle Crow Creek. (Fish and Wildlife Service Coordination Act Report 1980).

- i. Any support facilities in association with the construction or operation of the proposed system have to be designed to be compatible with the visual quality of the area.
- j. All disturbed areas would be revegetated to standards prescribed by the Forest Service.
- k. Merchantable trees would be harvested, sold and removed from the project area.

# C. SUMMARY OF ENVIRONMENTAL EFFECTS

There would be from 520 - 1907 acres of range and wildlife habitat inundated by raising the levels of Hog Park, Rob Roy, and/or Little Snake Reservoirs. The suggested mitigation for these losses in the 1980 Draft U.S. Fish and Wildlife Coordination Act report was to have additional lands purchased by the proponent. These lands would be managed by the U.S. Forest Service or Wyoming Game and Fish Department for wildlife values. The Forest Service does not concur with this recommendation as stated. Currently these projected possible losses will not be mitigated. Additional effects are summarized in Table 3-1.

# D. FOREST SERVICE PREFERRED ALTERNATIVE

The preferred alternative is Alternative C. It would meet Cheyenne's need for water until the year 2000 (based on midrange population projection); it best resolves public issues; it is the most economically feasible among the action alternatives; it best meets resource management concerns among the action alternatives.

# E. AREAS OF CONTROVERSY

1. Since the alternative may affect threatened or endangered species (Colorado squawfish and humpback chub), consultation with the U.S. Fish and Wildlife Service has been initiated. Formal consultation with the U.S. Fish and Wildlife Service will be continued to insure that effects on threatened and endangered species are properly addressed.

## 2. Issue Questions:

- a. Does the City of Cheyenne need more water?
- b. What are the alternative sources and methods of developing and transporting the water?

- c. What would be the effect of increased stream flows resulting from the interbasin transfer of water?
- d. What would be the effect of decreased stream flows resulting from the interbasin transfer of water?
- e. What would the fluctuations in the water level be during the recreation season at Hog Park and Rob Roy Reservoirs?
- f. What effect will the current and potential reduction in flows have on the salinity of the Colorado River and its affected tributaries?
- g. What would be the overall effects of the newly roaded access in essentially undeveloped and unroaded areas?
- h. What effect would the proposal have on Colorado River cutthroat trout habitat?
- i. What would be the effect on the rights of downstream water users in the Little Snake River Valley?
- j. What impact would the project have on known threatened or endangered species?



# C. SUMMARY OF ENVIRONMENTAL EFFECTS TABLE 3-1

	ALTERNATIVE	ALTERNATIVE	ALTERNATIVE	ALTERNATIVE	ALTERNATIVE	ALTERNATIVE	ALTERNATIVE
	Α .	В	С	D	Е	F	G
1. Economic Feasibility a. Amount of Water Delivered to Cheyenne Approximately 80% Collector Efficiency	7,400	27,500	21,500	27,500	27,500	27,500	27,500
b. Cost to the Consumer - Rate per 1000 gal. 1978 Dollars - Rate per acre-foot	\$.82	\$1.50	\$1.40	\$3.00	\$2.37	\$2.37	\$1.92
c. Cost to City - Rate per 1000 gal. 1978 Dollars - Rate per acre-foot	\$.29	\$.66	\$.58 \$189	\$1.13 \$369	\$.91 \$298	\$.88 \$287	\$.77
<ul> <li>d. Project Construction Cost         1978 Dollars</li> <li>e. Annual Maintenance Cost - 1978 Dollars</li> </ul>		\$75,924,000	\$63,000,000	\$111,706,000	\$81,132,000	\$73,487,000	\$71,781,000
Does Not Include Annual Special Use Fee	\$50,000/yr.	\$126,500/yr.	\$113,900/yr.	\$2,405,260/yr	\$2,409,310/yr	\$2,569,830/yr	\$1,654,880/yr
f. Forest Service Administrative Costs, Construction/Maintenance - 1978 Dollars	500	25,000	23,000	15,000	28,000 900	25,000	25,000
g. Electrical Power Consumed - Kilowatt Hours	14,700	14,700	14.700	33,320,000	33,350,150	.35.879.850	22,424,850
2. Resource Management Concerns a. Watershed	0	453 Ac	453 Ac	514 Ac	246 Ac	246 Ac	246 Ac
1) Riparian Habitat Altered							
2) Salinity	0	1.73 mg/1	1.73 mg/1	1.73 mg/1	1.73 mg/1	1.73 mg/1	1.73 mg/1
b. Fisheries 1) Game Species Existing	4	4	4	4	4	4	4
2) Trout Streams Diverted	0	13	11	4	9	9	9
3) Miles of Stream Inundated	0	9.7	9.7	14.6	5.8	5.8	5.8
4) Trout Habitat Units Lost	0	447	440	814	149	12,292	12,807
Dispersed Recreation Change     Semi-Primative to Rural	0	8400 Ac	6300 Ac	2700 Ac	8400 Ac	8400 Ac	8400 Ac
<ol> <li>Developed Recreation Sites         Displaced and Relocated     </li> </ol>	0	375 PAOT	375 PAOT	375 PAOT	185 PAOT	185 PAOT	185 PAOT
d. Wilderness Potential 1) Acres Available	67,322	62,112	65,892	67,322	62,112	62,112	62,112
2) Rating - Character Loss	0	-24	-9	-1	-28	-30	-28
e. Soils 1) Surface Disturbance	0	2580 Ac	2454 Ac	3079 Ac	1940 Ac	1777 Ac	1739 Ac
2) Mass Land Failure	0	720 Ac	150 Ac	740 Ac	900 Ac	800 Ac	830 Ac
<ol> <li>Acres of Very Low Revegetation Potential</li> </ol>	0	590 Ac	320 Ac	500 Ac	900 Ac	512 Ac	680 Ac
f. Range - Crazing Capacity - AUM's Lost	0	-418	-414	-455	-309	-268	-268
g. Terrestrial Wildlife 1) Came Species Existing	5	5	5	5	5	5	5
2) Acres of Habitat Lost	0	1007	1007	1907	520	520	520
3) Consumptive Use - User Days	1100	2700	2700	1300	2700	2700	2700
4) Nonconsumptive Use - User Days	100	300	300	120	300	300	300

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E	ALTERNATIVE F	ALTERNATIVE G
h. Threatened or Endangered Fish Species Present Downstream	2	2	2	2	2	2	2
<ol> <li>Visual Resources - Acres of Outstanding Quality Altered</li> </ol>	0	493	493	493	493	493	493
j. Tree Resource - Acres Loss	0	532	532	532	250	250	250
k. Transportation - Roads, New Construction Miles	0	29.4	22.6	15.4	22.7	22.7	22.7
<ol> <li>Cultural Resources - Acres Needing Survey</li> </ol>	0	2580	2454	3079	1940	1777	1739
3. State - County Plans a. State Plans 1) Meets Goals Land Plan	100	100	100	100	100	100	100
2) Meets Goals Water Plan	0	100	87	100	100	100	100
b. County Plans 1) Meets Goals Land Plan	10	100	100	100	100	100	100
2) Meets Goals Water Plan	0	100	87	100	100	100	100
3) Domestic Water Use	0	100	87	100	100	100	100
4. Resolve Public Issues a. Cheyenne Needs Water	Y N_X	YX_ N	YX N	YX N	Y.X. N	Y X N	YX N
b. Alternative Water Sources Considered	Y_X N_	YX N	Y.X N	YX N	YX N	Y <u>X</u> N	YX N
c. Provide for Adequate Instream Flows	Y NX	Y.X. N	Y.X. N	YX N	Y X N	YX N	Y <u>X</u> N
d. Will Decrease Stream Flows Below Maintenance Level	Y N_X	Y NX	Y NX	Y <u>NX</u>	Y N.X	Y NX	Y NX
e. Minimize Reservoir Fluctuation	Y <u>X</u> N	YX N	YX N	YX N	Y <u>X</u> N	YX N	YX N
f. Increase Colorado River Salinity	Y N_X_	YX N	Y.X. N.	Y X N	Y <u>X</u> N	Y X N	Y_X N
g. Provide New Access into Unroaded Areas	Y NX	YX N	YX N	YX N	YX N	Y X N_	Y X N
h. Adversely Impact Sensitive Species Habitat	Y N X	Y NX	Y NX_	Y NX_	Y N_X_	Y N <u>X</u>	YNX
i. Provide an Adverse Effect on Downstream Users	Y NX	Y NX	YNX_	Y N X	Y NX	Y NX_	Y NX_
j. Adversely Affect Threatened and Endangered Species	YNX	Y N.X	Y _ NX	Y NX	Y NX	Y N_X_	Y N <u>X</u>
		8					

.

# TABLE OF CONTENTS

Section	<u>Title</u>	Page
I	Cover Sheet	1
II	Summary	2
III	Table of Contents	9
IV	Introduction	10
V	Affected Environment	21
VI	Evaluation Criteria	31
	•	
VII	Alternatives Considered	35
VIII	Effects of Implementation	79
IX	Evaluation of Alternatives	107
X	Identification of the Forest Service	
	Preferred Alternative	119
XI	Consultation With Others	123
XII	Index	139
XIII	Appendix	145

# IV. INTRODUCTION

CONTENTS															Page
The Need For Decision		•	•	•	•	•	•	•	•	•	•	•	•	•	11
Background	•	•	•	•		•	•	•	•	•	•	•	•	•	11
Description of Proposal	•	•	•	•	•	•	•	•	•	•	•	•	•	•	13
Identified Issues	•	•	•	•	•	•	•	•	•	•	•	•	•		15
Management Concerns	•	•	•	•	•	•	•	•	•	•	•	•	•	•	18
Needed Permits	•	•	•	•	•	•	•	•	•	•	•	•	•	•	20
Purpose and Need For Response					•										20

#### IV. INTRODUCTION

# A. THE NEED FOR DECISION

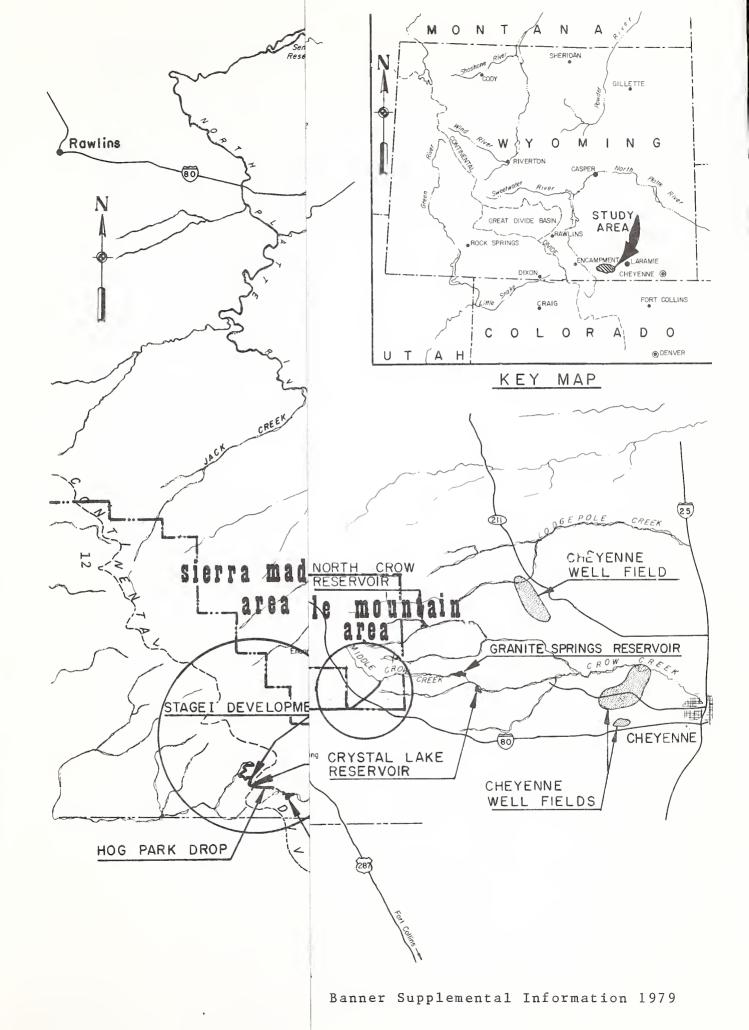
The Cheyenne Board of Public Utilities of Cheyenne, Wyoming, has filed an application with the Medicine Bow National Forest for a Special Use Permit to expand its existing Stage I water diversion facilities. The Forest Service must decide whether or not to issue this permit.

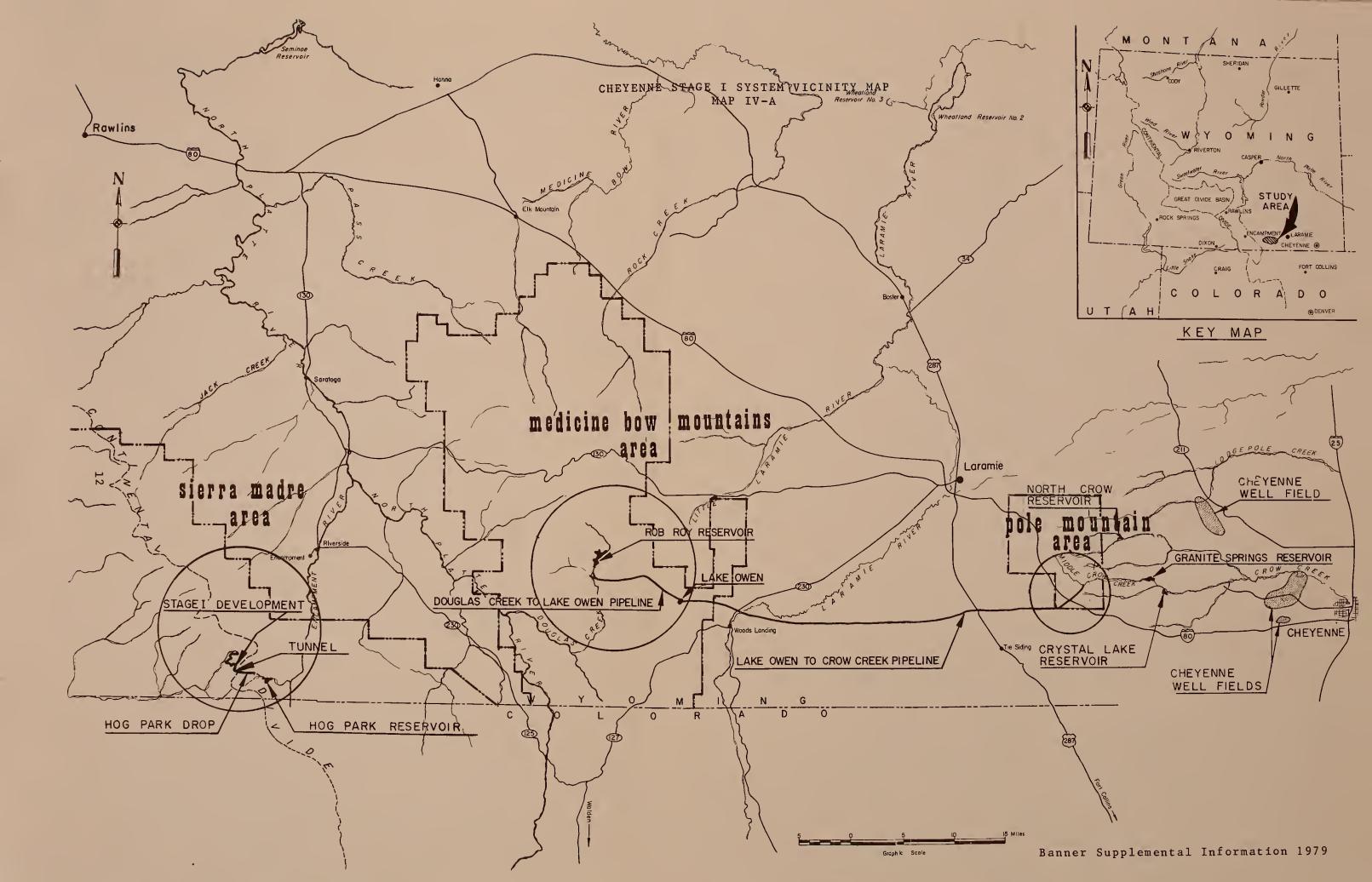
# B. BACKGROUND

The initial Stage I system was installed in the early 1960's and has the capacity to collect approximately 7,400 acre-feet of water annually. The Cheyenne Board of Public Utilities has determined this amount will no longer meet the needs of Cheyenne and they are requesting to expand their system to collect an additional 20,100 acre-feet.

Cheyenne's Stage I system, shown on Map IV-A, attached consists of three parts. The main portions of planned Stage II development are shown on Maps IV-A $_1$  and IV-B $_1$  located in the map pocket.

- 1. There are diversion and collection facilities, including one 174 acre reservoir in the Sierra Madre Mountains southwest of Encampment, Wyoming. This portion of the system collects water from tributaries of the Little Snake River in the Colorado River basin, transports the water under the Continental Divide and into Hog Park Reservoir. The water travels to the North Platte River via Hog Park Creek and the Encampment River. Since Cheyenne does not have permits for North Platte water, this is used as replacement water for water taken from Douglas Creek, and transported to Cheyenne.
- 2. The transmission and storage facilities in the Medicine Bow Mountains consist of a 314 acre storage reservoir, (Rob Roy Reservoir), a diversion structure on Douglas Creek, a small lake (Lake Owen), which acts as a pressure relief, and a pipeline to transport the water to Middle Crow Creek on Pole Mountain.
- 3. The third portion consists of a culvert drop into Middle Crow Creek near Vedauwoo Campground on Pole Mountain. The water travels via Middle Crow Creek to Crystal and Granite Reservoirs where it is stored for use by the City of Cheyenne.





# C. DESCRIPTION OF THE PROPOSAL

The proposal expands all three sections of the Stage I system. The areas are shown on Map IV-B attached and detailed Maps IV-A $_1$  and IV-B $_1$  filed in the map pocket.

Proposed facilities would expand the existing system to include diversion of First, Second, Third, Solomon, Deadman, Harrison, Rose, Rabbit, Sherard, and several smaller creeks plus West Branch of the North Fork and the Roaring Fork of the Little Snake River (Banner Supplemental Information 1979). 1

The diverted water would be transported to an expanded Hog Park Reservoir via pipeline and existing tunnel under the Continental Divide. The water would be released into the Encampment River and would flow to the North Platte River. This water would be used to replace water taken from the North Platte system out of Douglas Creek.

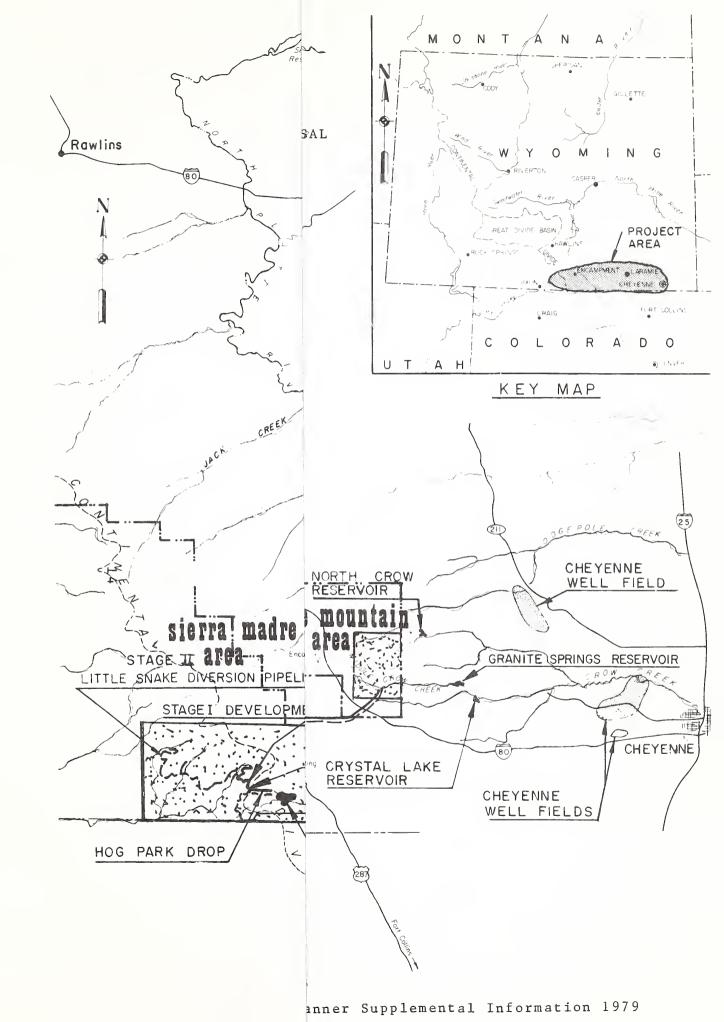
Water transported to the City of Cheyenne would be stored in an enlarged Rob Roy Reservoir located near Keystone, Wyoming. This water would be released into Douglas Creek, a tributary of the North Platte River, where it would flow in a natural channel for approximately one-half mile to a structure designed to divert the water into a pipeline. The pipeline would transport the water to Lake Owen, which would be used to decrease pipeline pressure. The water would enter the pipeline again at Lake Owen and cross the Laramie Plains near Woods Landing, Wyoming.

The Stage II transmission pipeline from Douglas Creek would be constructed in the existing right-of-way. Additional collection facilities would be developed in Lake Creek and Muddy Creek. These facilities would require a new right-of-way.

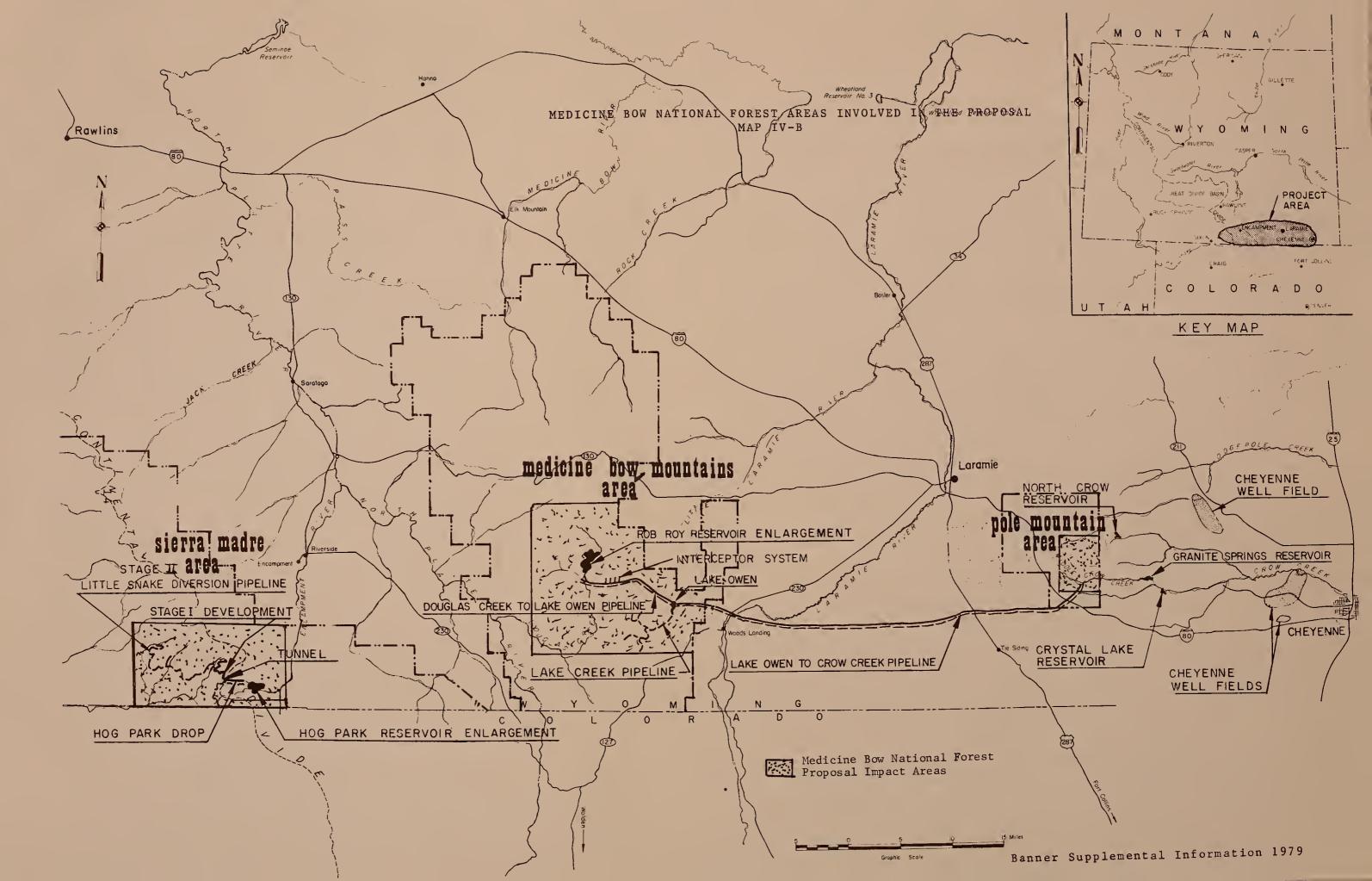
The transmission pipeline from Lake Owen would empty into Middle Crow Creek at the northeast corner of the Vedauwoo Campground on Pole Mountain.

<sup>1/</sup> Banner and Associates are the Project Engineers selected by the Cheyenne Board of Public Utilities. They provided input, as a representative of the Board of Utilities, requested by the U.S. Forest Service throughout the assessment process.

	- 6		



	4		



The City of Compenne has secured a grant and loan from the State of Wyoming for project construction, should approval be granted (Appendix VIII Enrolled Act Number 43).

This type of proposed use on Federal lands would be considered a use for which a written permit or easement is required.

# D. IDENTIFIED ISSUES

The issues listed below were identified:

- as a result of comments received at public scoping sessions,
- as a result of written public response forms distributed at public scoping sessions,
- as a result of public response to the Huston Park EIS and Land Management Plan,
- by other Federal and State agency interests.

Each of the identified issues is described and discussed below:

#### 1. THE CITY OF CHEYENNE NEEDS MORE WATER

Issue Question: Does the City of Cheyenne need more
water?

When the Stage I system was designed, the City of Cheyenne anticipated that the system would need to be enlarged by the year 2000 to meet projected population growth.

Cheyenne is experiencing rapid growth and the average annual water supply of 14,000 acre-feet is currently equal to consumption (Cheyenne Board of Public Utilities Statement of Need October 1978). Present use rates indicate consumption in 1990 would be 18,500 acre-feet and would increase to 22,500 acre-feet per year by the year 2000. These projections are based on a mid-range population estimate (WRRI Feasibility Study: 50 November 1979). There are high and low range projections for the same period of time which indicate a 3,000 acre-foot fluctuation above or below the mid-range projection.

There are 44 wells within 6-15 miles of Cheyenne which have been used historically as a reserve for peak demand periods. These wells in recent years have been pumped steadily to meet the normal system demands (Banner Supplemental Information: I-1 1979). Groundwater levels, monitored by the U.S. Geological Survey, have dropped approximately 20 feet in the last two years (Banner Supplemental Information: I-1 1979).

#### 2. ALTERNATIVE SOURCES OF WATER TO STAGE II

<u>Issue Question</u>: What are the alternative sources and methods of developing and transporting the water?

The City's proposal is for a gravity flow system operating similar to that of Stage I. A pumping system has been suggested in the Little Snake drainage and would involve a low elevation reservoir and a pumping station for lifting water into the Stage I system. The Stage I system could be redesigned to collect more of the available water. There is water available for collection that cannot be picked up by current facilities. Exploration of existing well fields in Albany and Laramie Counties has also been suggested. There is a large well at Morton Pass near the east entrance to Sybille Canyon.

#### INCREASED STREAM FLOWS

<u>Issue Question</u>: What would be the effect of increased stream flows resulting from the interbasin transfer of water?

Increased stream flows are of major concern because of their potential effects on stream channels and fish habitat. Hog Park Creek, the Encampment River, and small streams in the Crow Creek drainage could have increased flows.

There would be greater water flow in Hog Park Creek and streams in the Crow Creek drainage. These streams are now flowing at bank full capacity during spring runoff.

### 4. DECREASED STREAM FLOWS

<u>Issue Question</u>: What would be the effect of decreased stream flows resulting from the interbasin transfer of water?

Stage II, as proposed, would cause a flow reduction in Douglas Creek, the North Platte River, (between Douglas Creek and the Encampment River), the Little Snake River, Lake Creek, and their tributaries. Concern is expressed over achieving needed flows in these streams to maintain current aquatic habitats and insure available water for downstream users.

Decreased flows have had adverse effects on fish populations, recreation and aesthetics. A reduction of flow is also of concern to downstream water users.

# 5. RESERVOIR FLUCTUATION

Issue Question: What would the fluctuations in the water level be during the recreation season at Hog Park and Rob Roy Reservoirs?

Reservoir fluctuations would occur before and after the recreation season. During the period when heavy recreation use is anticipated, water levels are not expected to fluctuate. Fluctuating water levels will result in mud flats at both reservoirs.

## 6. COLORADO RIVER SALINITY

<u>Issue Question</u>: What effect will the current and potential reduction in flows have on the salinity of the Colorado River and its affected tributaries?

With a reduction in water volume from the collection area in the Little Snake drainage, salinity or dissolved salt concentration in the downstream waters may increase.

## 7. NEW ACCESS INTO UNROADED AREAS

<u>Issue Question</u>: What would be the overall effects of the newly roaded access in essentially undeveloped and unroaded areas?

There would be some type of access over the entire route of the proposed construction site in the Little Snake River and Lake Creek drainages. The construction between Rob Roy and the Forest boundary, on Pole Mountain would be within the Stage I area. There could be both temporary and permanent access roads. These roads must be large enough for large machinery.

### 8. SENSITIVE SPECIES HABITAT

<u>Issue Question</u>: What effect would the proposal have on Colorado River cutthroat trout habitat?

Stage II, as proposed, would divert water from several streams in the North Fork of the Little Snake River drainage which contain relatively pure populations of Colorado River cutthroat trout. The streams to be diverted are vital to the existence of this subspecies so any alterations to these streams must insure adequate maintenance flows and habitat protection. There would be increased access into relatively isolated habitats which could cause increased fishing pressure.

#### 9. DOWNSTREAM WATER USERS

<u>Issue Question</u>: What would be the effect on the downstream water users in the Little Snake River Valley?

There are also community concerns regarding availability of water for municipal and irrigation uses along the Little Snake system to meet their forecasted growth.

#### 10. THREATENED AND ENDANGERED SPECIES

<u>Issue Question</u>: What impact would the project have on known threatened or endangered species?

There are two species of fish (Colorado squawfish and humpback chub) in the Yampa and Green Rivers that fall into this classification. In addition there are two proposed species, the bonytail chub and razorback sucker. Their habitat needs are currently under study by the U.S. Fish and Wildlife Service.

# E. MANAGEMENT CONCERNS

There are Forest Service concerns regarding management of the natural resources within the proposed area. These concerns are as follows:

- 1. <u>Vegetative Species Changes</u> Mass land disturbing activities can and do result in temporary vegetative changes.

  Drastic changes in the micro climate of a specific area can affect species composition.
- 2. Effects on Fisheries This project involves streams that are of both regional and national importance as sport fisheries. It also involves the Colorado River cutthroat trout which is of major concern because of its limited habitat and the importance of the North Fork of the Little Snake River drainage to its continued existence.
- 3. Effects on Recreation The proposal could impact both developed and dispersed recreation. This impact would extend over the entire parcel of National Forest land that could be involved. Developed recreation sites that could be affected would be those in the vicinity of Rob Roy and Hog Park Reservoirs. Dispersed recreation could be affected by possible changes in roads, trails, stream and reservoir fishing, big game hunting access, other recreation access, and scenic values.

4. Effects on Soils and Potential for Mass Land Failure - A proposal of this type requires ground disturbance, if developed. Any ground disturbance increases the potential for increased soil erosion.

Factors such as steep slopes, saturated soils, aspect and sparse vegetative cover, which contribute to mass land failure, are present within the proposal area.

- 5. Effect on Range This type of activity could have an impact on forage production, alter natural barriers used for stock control, increase the potential for animal-people conflicts, and change use patterns.
- 6. Effect on Terrestrial Wildlife The proposal could cause changes in hunting pressures.
- 7. Effect on the Visual Resource A range of effects on the visual resource from none to extremely adverse could occur. Effects of up and down slope lines are hard, if not impossible, to mitigate and produce a harsh contrast, decreasing scenic quality.
- 8. Effect on Tree Covered Area The tree covered area could be impacted by roads, pipelines and reservoir inundation.
- 9. Effect on the Cultural Resource Development of the proposed facilities could entail surface disturbance on several thousand acres, depending on selected course of action. Much of the area has not been intensively inventoried for cultural or historical resources.
- 10. Effect on Social Structures There are two basic lifestyles that could be affected as a result of the proposal. One is the current rural-local community lifestyle represented in the Little Snake River Valley which is dependent on some water from within the proposed area.

The second major lifestyle is that of the "city complex" consisting of varied industries, supportive businesses, and residential habitation. This lifestyle is found in Cheyenne, Wyoming, and requires water to continue.

11. Effects on Endangered and Threatened Species - There have been concerns expressed as to the possible effect on two known endangered and two proposed endangered species of fish in the Yampa and Green Rivers.

## F. NEEDED PERMITS

There are four Federal permits which would be required for this proposal.

- 1. Construction Special Use Permit U.S. Forest Service.

  This permit would allow construction of the facilities associated with the selected alternative, providing the proposal is approved. It would contain all of the mitigation requirements listed in this Environmental Impact Statement. This temporary permit would be issued by the responsible Forest Service official to cover the construction phase only.
- 2. 404 Dredge and Fill Permit U.S. Corps of Engineers.

  This permit is required anytime there is land disturbance in a lake, stream or river. The adjustments of Hog Park and Rob Roy Reservoirs would require 404 permits for raising the dam. Permits would also be required for any diversion structure on streams having an average annual flow of 5 cfs or more.
- 3. Pipeline Crossing Permit Bureau of Land Management.
  This permit would be required to cross Bureau of Land
  Management land within the Laramie plains area outside of
  the Medicine Bow National Forest.
- 4. Operational Permit U.S. Forest Service. This permit would be for the operation of the system, if approved and installed under permit #1. It would contain all the requirements specified as monitoring criteria and mitigation requirements listed in this Environmental Impact Statement. It could be a permit or easement for the right-of-way occupied. A fee would be charged for this use. Annual fees are based on 5% of the appraised land value.

## G. PURPOSE AND NEED FOR RESPONSE

The Cheyenne Board of Public Utilities of Cheyenne, Wyoming has filed an application with the Medicine Bow National Forest for a Special Use Permit to expand its existing Stage I water diversion facilities.

## V. AFFECTED ENVIRONMENT

CONTENTS																					Page	5
Social Environmen	t.		•	•	•	•	•	•	•	•	•	•	•	•			•	•			22	
Water	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	23	
Fisheries	•	•	•	•	•	•	•	•		•	•	•		•	•	•	•	•	•		23	
Recreation	•	•	•	•	•	•	٠	•	•	•		•	•	•	•	•	•	•	•	•	25	
Wilderness	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•		27	
Soils	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•		27	
Range	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	28	
Wildlife	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	28	
Visual Resource .	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•		29	
Cultural History	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•		29	
Tree Cover	•		•	•					•		•	•						•	•		29	
Transportation							•														30	



### V. AFFECTED ENVIRONMENT

The three areas of the Medicine Bow National Forest that are affected by this proposal are: the Sierra Madre Mountains southwest of Encampment, Wyoming; the Medicine Bow Mountains west of Laramie, Wyoming; and Pole Mountain, within the Sherman Mountains, east of Laramie. There are portions of four sections of Bureau of Land Management lands which would be crossed by 2.15 miles of pipeline between Lake Owen and Middle Crow Creek.

All areas support a portion of the Stage I system. There would be new construction on all three areas. New construction in previously unaffected areas would be found primarily in the Sierra Madre area. Consequently the majority of newly affected environments also occur in this area.

## A. SOCIAL ENVIRONMENT

There have been several population projections made for areas within the proposal zone. The population of the Sierra Madre area, including Baggs, Dixon, Savery, Encampment and Riverside, is anticipated to increase from about 1000 population in 1977 to 7000 in 2000 (WRRI December 1979, Table B1). This trend is expected to occur as a result of the development of energy related materials close to these towns. These areas may also begin exceeding available water supplies which are, except for Encampment and Riverside, extracted from the same drainage basin where the City of Cheyenne has permits for water. Encampment and Riverside get their supplies from the North Fork of the Encampment River and private wells respectively.

Community growth in the Medicine Bow Mountains and Pole Mountain areas has not been estimated. Keystone, a resort community, uses groundwater for its domestic supplies. There is one subdivision planned for the Pole Mountain area and its water source is unknown. The major community within these two areas is Laramie, which presently is independent of Cheyenne's water supplies.

The population of Cheyenne is anticipated to increase from an estimated 45,000 people in 1977 to 96,984 in the year 2000 (WRRI December 1979, Table B-I, mid range level projection). There are also high and low projections of 118,490 and 56,426 for the year 2000 (WRRI December 1979, Table BI). Much of this growth is attributed to the energy boom in Wyoming. Water demand in Cheyenne is now equal to its available supply (Banner Supplemental Information 1979).

Estimates are that the consumer rates could possibly double, depending on what alternative is selected (Banner Supplemental Information Table IV-8 1979).

## B. WATER

There are two components of water quality that may be affected - turbidity and salinity. Currently neither is a problem within the proposal area. Salinity is a problem on the lower reaches of the Colorado River. Overall the water on the proposal area was tested for about twenty different items and surpassed standards for all but heavy metal concentrations (Wyoming Department of Environmental Quality 1979).

Water quantities are sufficient to maintain viable fish populations in all but those streams which have Stage I diversions on them. These streams do recharge, usually within one mile, to a water level capable of supporting a fishery.

A minimum of 180 cfs is being maintained at the Dixon, Wyoming stream gauge to supply downstream uses (Banner Supplemental Information 1979). The State Engineer has issued water permits for the quantities of water proposed for diversion to the City of Cheyenne.

## C. FISHERIES

The Colorado River cutthroat trout is a subspecies presently classified by states as "endangered" in Utah, "threatened" in Colorado, and "sensitive" in Wyoming. The American Fisheries Society has recognized the need for protecting the natural habitats of this subspecies and has listed it in a "special concern" category.

The Colorado River cutthroat trout is native to the North Fork and Roaring Fork drainages of the Little Snake River and historically was the only native trout species present in these two drainages. However, these populations have been reduced by competition and hybridization with species which have been introduced into the Little Snake River and many of its tributaries. The competitive ability of the Colorado River cutthroat trout is questionable and this trout does best when other species are absent or at minimal levels (Binns, 1977). Brook trout have almost entirely replaced the cutthroat population in a section of the Roaring Fork sampled by Wesche (1977). Brook trout were found in Sherard Creek, a tributary to the Roaring Fork. The West Branch population of Colorado River cutthroat trout is extensively hybridized with rainbow

trout (Binns, 1977). Brook trout have also moved up the West Branch and represent a threat to the cutthroat population in this stream and its tributaries. The North Fork and its tributaries above the West Branch contain the largest population of essentially pure Colorado River cutthroat trout remaining (Binns, 1977). These populations have been protected from upstream movement of other species by a fish barrier installed by the Wyoming Game and Fish Department in 1977.

The existing populations of Colorado River cutthroat trout in the North Fork, Ted Creek, and Green Timber Creek have declined from a loss of habitat associated with decreased stream flows since the completion of Cheyenne's Stage I diversion facilities in the early 1960's. There were no instream flows established below the Stage I diversion structures in the North Fork of the Little Snake River drainage. These structures annually dry up sections of streams immediately below the diversions. There are decreasing levels of impact as groundwater and small tributaries contribute water downstream.

Colorado River cutthroat trout populations sampled in the streams affected by the Stage I diversion, revealed population estimates ranging from 9.2 to 22.1 lbs. per surface acre. Trout populations in comparable streams unaffected by Stage I ranged from 29.7 to 62.1 lbs. per surface acre. Low flows below the Stage I diversion structures not only reduce the quantity of available trout habitat as a direct result of less water, but also reduce the quality of available habitat due to the relationship between the remaining flow and the stream channel.

Hog Park Creek contains well established populations of brook, brown, and rainbow trout. During the Stage I construction of Hog Park Reservoir, flows in Hog Park Creek below the reservoir were increased as water was paid back to the North Platte system on a daily basis. Channel stability ratings conducted by Wesche (1977) and Forest Service (1979) indicated few, if any, longlasting detrimental effects associated with this increase in flow. The percentage flow increase in the Encampment River, due to its larger drainage area, is less than in Hog Park Creek and was, therefore, not considered significant.

The Douglas Creek drainage contains well established populations of brook and brown trout and a few nongame species. The existing populations of brook and brown trout in Douglas Creek are affected by a loss of habitat associated with decreased stream flows since the completion of Cheyenne's Stage I diversion facilities. There is also a small section of Horse Creek which was completely dry during the 1979 field season resulting from Stage I diversion. A one cubic foot per second flow requirement below the Douglas Creek diversion structure was the only flow requirement established for Stage I. This flow is considered inadequate to maintain a desireable trout population in Douglas Creek.

In addition to low flows, fish populations in Douglas Creek are subject to extreme flow fluctuations resulting from inconsistent reservoir water releases. Extreme unregulated releases, which cause flow fluctuations, are detrimental to fish and macroinvertebrate populations. Trout populations reported by Wesche (1974) ranged from 7.5 to 183.1 lbs. per surface acre at various distances below the Douglas Creek diversion structure. These populations increased as the distance below the diversion structure increased. Trout populations sampled in proposed Stage II tributaries of Douglas Creek revealed populations ranging from 31.8 to 171.8 lbs. per surface acre. These streams are in their natural state with unobstructed flows.

There has been no federally designated critical habitat or endangered and threatened fish species identified as being present within the immediate planned construction area of this proposal. Downstream from the proposal site within the Colorado River drainage the following species have been identified as:

## ENDANGERED

<u>Gila cypha</u> - humpback chub Ptychocheilus lucius - Colorado squawfish

## SPECIES PROPOSED FOR ENDANGERED OR THREATENED CLASSIFICATION

<u>Gila elegans</u> - bonytail chub Xyrauchen texanus - razorback sucker

Habitats for these warm water species are found approximately 100 miles downstream from the project area in the Yampa River below its confluence with the Little Snake River.

All are present within segments of the Yampa River that pass through the Dinosaur National Monument, currently under study by the National Park Service for inclusion into the Wild and Scenic River system (National Park Service - Draft Environmental Impact Statement - Green & Yampa Rivers 1979).

The Yampa River is determined to be one of the most important rivers for the survival of the species (National Park Service - Yampa & Green Rivers, Draft Environmental Impact Statement: 240, 1979). Their decline results from alteration of their aquatic habitat through various water projects within the affected river basin(s) (National Park Service - Green & Yampa Draft Environmental Impact Statement - 1979).

## D. RECREATION

## 1. DEVELOPED FACILITIES:

a. Rob Roy Reservoir Campground and Boat Launch. This reservoir is used for storage of water. The dam on Douglas Creek was built in 1961 as part of the

Cheyenne Stage I system. Currently this reservoir has a storage capacity of 8,895 acre-feet (Banner Supplemental Information 1979). The reservoir is stocked with trout.

The campground and boat launch facility is located along the north side of Rob Roy Reservoir. There is a 22 unit campground and a boat launch parking lot complex extending to the water's edge.

Camping activities are water oriented with both reservoir and stream fishing.

There is a road system along the north and west side of the reservoir.

- b. Hog Park Reservoir Lakeview Campground and Boat
  Launch. This reservoir is at the head of the system
  with a storage capacity of 2,970 acre-feet (Banner
  Supplemental Information 1979). There is a 35 unit
  campground and boat launch on the west shore of the
  reservoir. Much of the public use is lake fishing
  from shore and boat. Water levels fluctuate according to supply and Cheyenne's demand. Late season
  water levels lower to meet demands of Cheyenne.
  Fluctuations are not serious during the recreation
  season June through August.
- c. Vedauwoo Picnic and Campground. This is an 80 unit picnic and 11 unit campground located on Pole Mountain. The current Stage I pipeline skirts the south and east boundary of this area and empties water into Middle Crow Creek at the northeast corner of the picnic area. Stream flows at Vedauwoo are sometimes erratic, from bank full to dry. When water is present, the area has more attraction than when dry. High flows occur during spring runoff and drop in the late fall. Middle Crow Creek, one to two miles below Vedauwoo, is considered one of the major fisheries in the Pole Mountain area (Wyoming Game & Fish Consultations 1979).

## 2. DISPERSED RECREATION

There are several forms of dispersed recreation on the Medicine Bow National Forest. Recreation opportunities affected are displayed in Table I, and on Maps V-l and V- 2 Appendix V.

### E. WILDERNESS

RARE II areas identified for wilderness or further planning that could be affected by Stage II developments are:

- 1) Platte River C2080; 20,262 acres
- 2) Encampment River 02086; 10,365 acres
- 3) Huston Park A2087; 31,485 acres
- 4) Huston Park C2087; 5,210 acres

Each area is further described in Appendix V.

## F. SOILS

Soil parent materials include granite, gneiss, and sandstone residuum; glacial till and outwash; and alluvium. Depth to bedrock ranges from 0 to 60 plus inches. Precipitation ranges from 15 to over 45 inches per year. Slopes range from 0 to 60 percent.

Elevations range from 7,250 to 10,560 feet. Soil drainage classes include very poorly, poorly, moderately well, well, and excessively drained. Vegetation present ranges from alpine meadows to sagebrush. In general, soils and most factors affecting soil development vary over a wide range throughout the area.

Tables V 3-5 (Appendix V) list all the soil mapping units, some basic properties, and interpretations.

Most of the soils within the area being considered are still under natural vegetation and meet the cover requirements to stay below soil loss tolerances. Only existing roads and developments, including Cheyenne's Stage I development, have segments with less soil cover than recommended.

### G. RANGE

The proposal involves four sheep allotments and five cattle allotments. These allotments currently support 3,126 sheep and 2,144 cattle between June 1 and October 1 (District Range Files: Hayden & Laramie RD). Table V-6 shows the individual breakdown by allotment. Those marked with an asterisk (\*) are allotments that are within the proposal area where new construction could occur. The remainder fall within the area where the Stage I system is now located.

TABLE V6

Grazed Species	Number of Stock	Season of Use	Permittee(s) Number
Sheep	1000	6/25-9/10	1
Sheep	1126	7/1-9/15	1
Sheep	1000	7/1-8/30	1
Cattle	232	7/1-9/15	3
Sheep		7/11-8/25	Vacant
Cattle	75	7/1-9/30	1
Cattle	808	6/16-9/30	3
Cattle	458	6/1-10/15	3
Cattle	571	6/1-10/15	2
	Sheep Sheep Sheep Cattle Sheep Cattle Cattle	Species of Stock  Sheep 1000 Sheep 1126 Sheep 1000 Cattle 232 Sheep Cattle 75 Cattle 808 Cattle 458	Speciesof Stockof UseSheep10006/25-9/10Sheep11267/1-9/15Sheep10007/1-8/30Cattle2327/1-9/15Sheep7/11-8/25Cattle757/1-9/30Cattle8086/16-9/30Cattle4586/1-10/15

All allotments have improvements such as water troughs, fences, stock driveways, or corrals associated with the management of the allotment.

#### H. WILDLIFE

## 1. Animals

There are three big game species present throughout the proposal area. They are: elk, deer, and black bear. There are also two small game species present, snowshoe hare and blue grouse. Numerous other small animals inhabit the area.

There are no known endangered plant or animal species within the affected area.

It is estimated that consumptive use of big game species is 1,100 user days. Nonconsumptive use is 100 user days.

## 2. Habitat

There is a variety of vegetation present to meet wildlife needs. The elevation ranges from 7,250 feet to 10,560 feet. Alpine and subalpine meadows containing many species of forbs and grasses providing forage for wildlife, are at the highest elevations. At the next lower zone is Engelmann spruce and subalpine fir, which is important for cover, bedding areas, and food sources for rodents. The middle zone is occupied by lodgepole pine which provides cover.

Aspen is generally found at lower elevations or at upper elevations mixed with fir on south and west aspects. These areas are used for grazing by larger animals and provide food, water, and cover for many nongame species. In foothill areas are oak brush, serviceberry, and grasslands which provide winter range for browsing animals.

## I. VISUAL RESOURCE

There are two areas of outstanding visual resource quality.

Hog Park has all the ingredients of an outstanding visual resource. The combination of open meadow and conifer, coupled with the flat mirror plane of water reflecting the scenic mountains in the background, provides contrast and variety of a high aesthetic quality.

The area from the West Branch to Deadline Creek just below the proposed Huston Park Wilderness is outstanding. The meadow, parks, vegetation, and rock outcrops provide a unique combination of variety.

## J. CULTURAL HISTORY

Only about 50% of the Stage II project area has been included in completed cultural history inventories.

The National Register of Historic Places has been examined as well as the most current listing by the Wyoming State Historic Preservation Officer. There are no properties or sites listed within the project area that are on, eligible for inclusion, or recommended to be on the list.

### K. TREE COVER

The tree cover consists of stands of pine, spruce, and fir. All occur mixed with aspen on selected sites. These areas, depending on their stocking, size, and species are rated as commercial or noncommercial forest land. There is about 532 acres of the commercial forest land involved in the proposal area.

### L. TRANSPORTATION

There are roads extending to the east boundary of the proposed collection area in the Sierra Madre Mountains. This includes roads linking Hog Park, Rob Roy, and Pole Mountain to surrounding communities of Encampment, Albany, and Laramie.

These roads are limited to snow free season use due to their elevation. They become snowed in around November 1st and are closed until late June except in the Pole Mountain area where they open up in late April or early May.

There is a road along the Stage I facilities used for permit and other resource administration. The network of roads is a part of the Forest Service transportation system.



## VI. EVALUATION CRITERIA

CONTENTS																Page
Evaluation	Criteria	Statem	ent	•	•	•	•		•	•	•	•	•	•	•	32
Evaluation	Criteria															32

## VI. EVALUATION CRITERIA

Evaluation criteria are statements used as a means to judge and evaluate alternatives for the purpose of identifying a preferred alternative.

The effects that would result from each alternative will be analyzed and documented using the units of measure listed below each general evaluation criterion.

## A. ECONOMIC FEASIBILITY

How well does each alternative meet the needs of Cheyenne in terms of economic feasibility.

- Amount of water delivered to Cheyenne acre-feet per year.
- 2. Cost to consumer 1978 dollars per 1000 gallons and per acre-foot.
- 3. Cost to Cheyenne 1978 dollars per 1000 gallons and per acre-foot.
- 4. Project construction cost 1978 dollars.
- 5. Maintenance cost 1978 dollars per year.
- 6. Forest administration costs construction/maintenance 1978 dollars per year.
- 7. Electric power consumed kilowatt hours.

### B. RESOURCE MANAGEMENT CONCERNS

How well does each alternative meet National Forest resource management concerns.

## 1. Watershed

- a. Riparian habitat altered by inundation acres.
- b. Salinity mg/l of total dissolved solids at downstream locations.

#### 2. Fisheries

- a. Game species present number of species.
- b. Streams diverted number of.
- c. Miles of stream inundated miles of stream.
- d. Net habitat units lost habitat units (HU).

### 3. Recreation

- a. Recreation opportunity spectrum acres of change semiprimitive to rural or roaded natural.
- Developed recreation sites displaced and relocated - PAOT/DAYS.

#### 4. Wilderness

- a. Potential acres.
- b. Rating character loss.

## 5. Soils

- a. Total surface disturbance acres.
- b. Mass failure potential acres.
- c. Acres of very low revegetation potential acres.

## 6. Range

- a. Livestock use permitted AUM's.
- b. Grazing capacity AUM's.

### 7. Terrestrial Wildlife

- a. Game species present number of species.
- b. Habitat lost acres.
- c. Consumptive use user days.
- d. Nonconsumptive use user days.
- 8. Threatened and Endangered fish species present downstream number.
- 9. Visual Resource acres of outstanding quality altered.
- 10. Tree resource lost acres lost.
- 11. Transportation roads new construction miles.
- 12. Cultural Resources acres needing survey.

## C. STATE AND COUNTY PLANS

How well does each alternative meet state and county plans?

- 1. State Land Plans
  - a) Meets goals land plan percent compliance.
  - b) Meets goals water plan percent compliance.
- 2. County Plans
  - a) Meets goals land plan percent compliance.
  - b) Meets goals water plan percent compliance.
  - c) Domestic water use percent compliance.

## D. PUBLIC ISSUES

How well does each alternative resolve public issues?

1.	The City of Cheyenne needs water -	yes-no
2.	Require alternative water sources considered -	yes-no
3.	Provide adequate instream flows -	yes-no
4.	Will decrease stream flows below maintenance level -	yes-no
5.	Minimize reservoir fluctuation -	yes-no
6.	Increase Colorado River salinity -	yes-no
7.	Will provide new access into unroaded areas -	yes-no
8.	Adversely impact sensitive species habitat -	yes-no
9.	Provide a major adverse effect on downstream water users -	yes-no
10.	Adversely affect threatened and endangered species -	ves-no



## VII. ALTERNATIVES CONSIDERED

CONTENTS	Page
Formulation of Alternatives	. 36
Requirements That are a Part of Each Alternative	. 36
Alternatives Eliminated From Detailed Study	. 38
Facets of Alternatives to be Compared	. 40
Description of Alternatives	. 43



## VII. ALTERNATIVES CONSIDERED

## A. FORMULATION OF ALTERNATIVES

The alternatives involved with this proposal were formulated utilizing the following as guidelines:

- 1. The original proposal submitted by the City of Cheyenne.
- 2. Public scoping sessions.
- 3. Inservice and interagency working sessions with other State, Federal and local agencies.
- 4. Responses from public scoping sessions and from comments to the Huston Park Environmental Impact Statement.
- 5. Consideration of the conditions set forth for the management of Forest resources designated in the Huston Park Land Management Plan.
- 6. Comply with Federal and State laws and/or regulations.
- 7. Provide for required or needed instream flows for all National Forest uses.
- 8. Not adversely affect any threatened and endangered species.
- 9. Meet State water quality standards.
- 10. Be within the framework of the Huston Park Land Management Plan.
- 11. Conform with Region Two management direction.
- 12. Provide for a minimum of on-site disturbance.
- 13. Provide for a deferred payback system.
- 14. Must be technologically feasible meeting National Forest engineering standards of design and provide for protection of associated National Forest resources.

## B. REQUIREMENTS THAT ARE A PART OF EACH ALTERNATIVE

- 1. Each must comply with laws, regulations and executive orders.
  - a. Executive Order 11593 requires a 100% archeological survey be done prior to any land disturbing activities.
    - 1) A 100% survey would be required from 0-3080 acres depending on the alternative.
    - 2) Survey must be completed prior to any construction.
  - b. Protect threatened or endangered species fishes and habitat downstream in the Colorado River drainages.

- 2. Mitigation that is a part of each action alternative.
  - a. All Stage I and Stage II diverted streams would have a maintenance flow to insure 100% of the fishery and riparian habitat will be protected (see Appendix Table VII-3 and Appendix VIII Section 2).
  - b. Wildlife habitat loss mitigation measures include fencing 100 acres of potential riparian habitat on Pole Mountain in the Green Mountain C & H The fence would be constructed to keep Allotment. livestock out of the stream bottom except where water gaps would allow livestock to drink and cross back and forth. Livestock utilization would be improved as cattle would be forced to graze away from the stream bottom on areas presently receiving light use. Permitted livestock numbers should not be adversely affected on the Green Mountain C & H Allotment. Wildlife Service Coordination Act Report -Draft 1980.)
  - c. A water release system from Hog Park Reservoir must be devised to insure that Hog Park Creek and Encampment River channels are protected. The wilderness character of the Encampment River would not be altered.
  - d. All diversion structures on major streams would be designed to allow a permanent unadjustable flow to bypass the structure at the rate specified for that stream.
  - e. Rights-of-way would be feathered by selective removal of trees along edges to provide for a softening edge effect and blend with the landscape instead of having a straight line appearance.
  - f. Roads, wherever possible, would be on the same location as the pipeline to reduce construction impacts on the resources.
  - g. Re-establish any destroyed facilities such as campgrounds, existing access roads and administrative sites.
  - h. South Branch of Middle Crow Creek would be augmented by 3-5 cfs. The water that is not used for instream augmentation, must be transported across Pole Mountain by some method other than allowing additional amounts to flow down Middle Crow Creek. (Fish and Wildlife Service Coordination Act Report Draft 1980.)
  - i. Any support facilities in association with the construction or operation of the proposed system have to be designed to be compatible with the visual quality of the area.
  - j. All disturbed areas would be revegetated to standards prescribed by the Forest Service.
  - k. Merchantable trees would be harvested, sold, and removed from the project area.

- 3. Items requiring monitoring as a part of each action alternative.
  - a. Flows in streams from which water is diverted.
  - b. Augmented flows into the Encampment River.
  - c. Flows in Douglas Creek.
  - d. Water releases from reservoirs into streams.
  - e. Bypass flows for downstream users.
  - f. Revegetation.
  - g. Turbidity and other water quality parameters during and after construction.
  - h. Soil loss during construction and maintenance.
  - i. Water quality.

## C. ALTERNATIVES ELIMINATED FROM DETAILED STUDY

- 1. Growth Management Although this option is not adverse to any of the formulation criteria, there are outside influences such as energy development, political orientations, and regulations that put this alternative primarily in control of the city government and citizens of Cheyenne.
- 2. <u>Water Recycling</u> There was no information presented that indicated this option was technologically feasible.
- 3. Weather and Streamflow Modification in Stage I Area -Weather and streamflow modification is currently an experimental science. There are several methods, including cloud seeding, vegetative manipulation, and snow fencing to keep snow in the area, that are being used to increase water yields. According to a 1978 field study in the proposal area, the heavy forest cover allows little chance to augment streamflow through snow entrapment. Potential yields would increase approximately 500 acre-feet. At this time, there is little reason to believe management techniques would appear cost-effective (Appendix VIII Section 1 Cheyenne Stage II Water Input - Ronald Tabler, October 4, 1978 letter). Vegetative manipulation studies are planned. There is a lack of data within the proposal area to indicate it is feasible to increase water yield through vegetative manipulation.
- 4. Purchase of Wells in Laramie and Albany Counties This option has been explored by the City of Cheyenne
  and due to uncertainty of supply and low benefit/cost
  it was considered not economically feasible at this
  time.

- 5. Water Conservation and Rationing There is not enough water currently available to meet demand through conservation (Banner Supplemental Information 1979).
- 6. Cheyenne Proposal This action was dismissed because
  Cheyenne did not propose to mitigate unacceptable impacts.
  It also does not meet the alternative formulation criterion of providing for "instream flows" in diverted streams.

The dewatering of the proposed streams included important habitat for the Colorado River cutthroat trout, which is considered sensitive. Further degradation of their habitat could result in an endangered classification and result in serious limitation on future Forest management options. Unacceptable impacts were water and fishery oriented. Habitat loss was of great concern to the United States Fish and Wildlife Service.

There would be impacts on natural habitats for deer and elk which were not considered in the original proposal. These impacts involve access into unroaded areas.

The enlargement of Hog Park and Rob Roy Reservoirs would inundate 1,007 acres of land including wet and dry meadow habitats. As submitted, the proposal would also inundate 9.7 miles of brook trout stream. Unregulated releases would further disrupt 23 miles of brown trout streams (Fish & Wildlife Service Coordination Report 1980). The planned release schedule from Hog Park Reservoir would have resulted in excessive channel scouring of Hog Park Creek and the Encampment River. There were no provisions that would minimize the possibility of spring season flooding of residences, headgates, bridges or trails downstream along the Encampment River.

Collector systems, under this action, would have the potential of dewatering an additional 40 miles of brown and brook trout habitat plus the possibility of drying up 80 acres of wet meadow habitat (Fish and Wildlife Service Coordination Report - Draft 1980).

## D. FACETS OF ALTERNATIVES TO BE COMPARED

The following descriptions will be used to compare the alternatives. These facets, as they relate to each alternative, are graphically displayed in Table VII-4.

- 1. Diversion Structures - These would be structures cast from concrete and used to divert water from its natural course into the Chevenne water system. These structures would be of two types. The ones used in major stream courses would be of a wing dam design. The water would flow through a grate into the collection system. A built-in bypass would return the required amount of water to the stream course for maintenance of current downstream uses. A second type would be much smaller and would be used in the ditches of the roads or on hillsides to collect surface runoff. These would be similar to a manhole with a grate cover flush to the ground. Water would be taken in through the top as it flowed across and into the pipeline below (See figures VII-1 and VII-2 Appendix VII for conceptual design).
- 2. Pipelines - These would be the pipes used to gather and transmit the water. They are planned to vary in size from 18 to 72 inches in diameter. Their construction would be steel for the smaller pipe and reinforced concrete for the larger ones. They would be installed in a prescribed variable width right-of-way of minimum design to accommodate the improvements. The top would be buried four feet below the surface. Those areas west of the Stage I system would be new construction while those sections which parallel the current system would be in the same previously disturbed right-of-way. The entire system constructed as planned would be 90.6 miles. All designs and locations would be approved in advance of construction by the Forest Service.
- 3. Roads A construction and maintenance access road system is needed for the proposal. Road design would be the minimum necessary to permit the planned service. Most of the new collection area is unroaded and access is very limited. Routes could be put on top of the pipeline to limit land disturbance over a large area. The entire new road system, as planned, would be on the same right-of-way as the pipeline wherever practicable. These roads could then become part of the Forest Service transportation system.

The first five miles extending west from Stage I would be part of a planned east west system road. The remainder of the pipeline access would be for recreation, timber, administrative, and maintenance uses.

4. Dams - There would be dam construction at Rob Roy and Hog Park Reservoirs, or a new reservoir constructed at a low elevation on the North or Middle Fork of the Little Snake River. Neither Hog Park nor Rob Roy Reservoir is large enough to store the additional water the proposal would add to the system. Both would have earthen dams adding approximately 50-60 feet to Hog Park and Rob Roy Reservoirs. If a reservoir were built where selected at the lower elevation, an earthen dam 325 feet in height would be required and it would flood 400 acres (Banner Supplemental Information 1979). These dams would all be designed with necessary spillway and flood control structures to meet Federal and State regulations. The complete plans and specifications would be reviewed by the Forest Service USDA.

TABLE VII-4

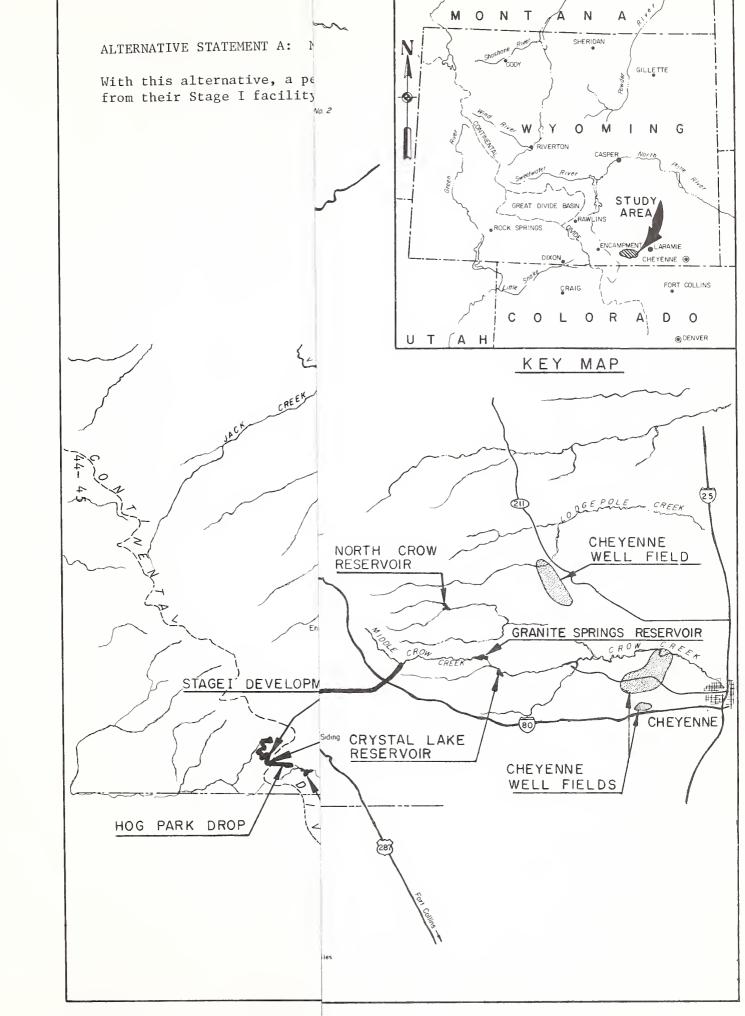
Diversion Structures Pipelines Number Miles
0
30
22.3/
8-1/
30
30
30

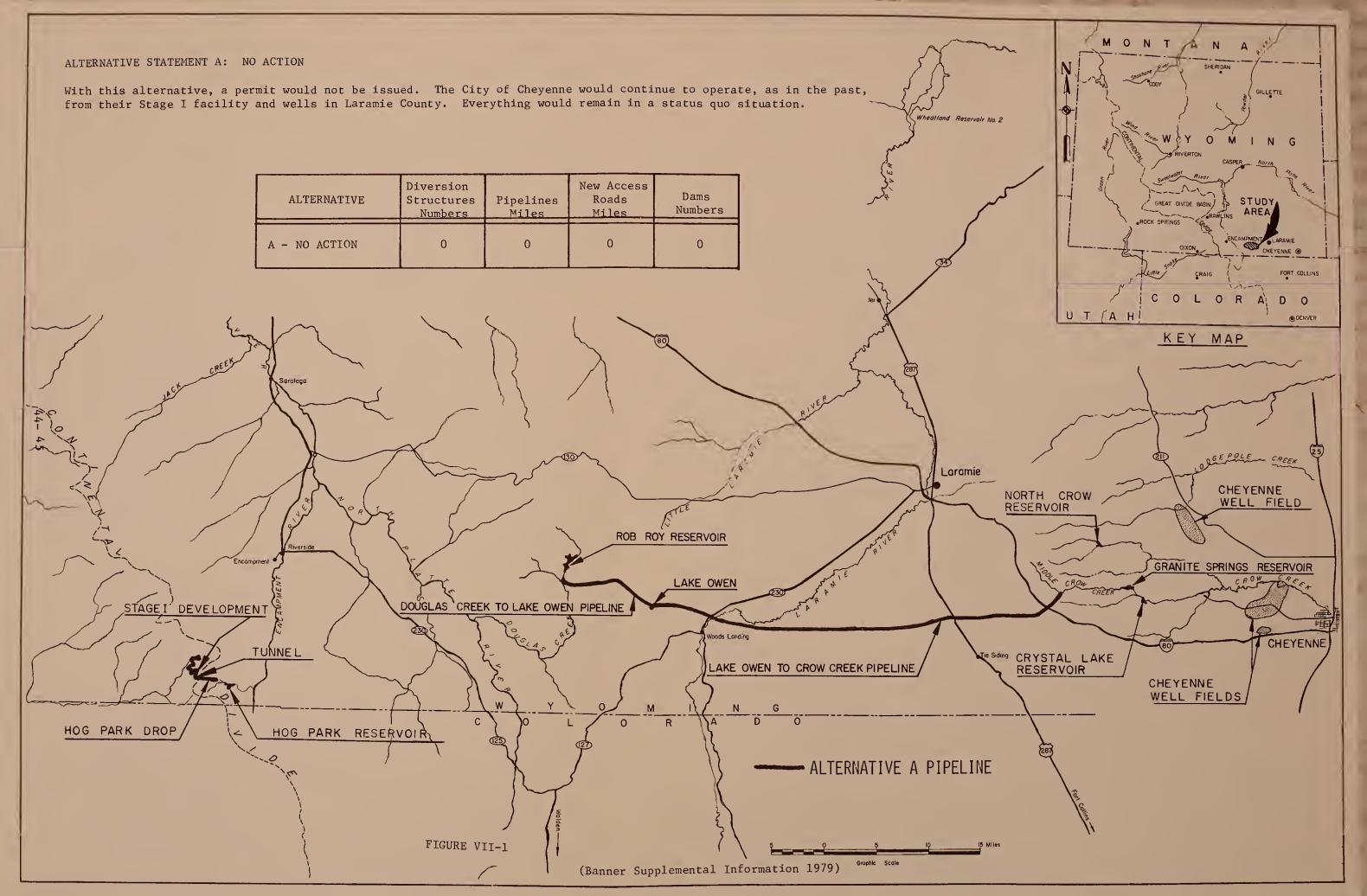
# KEY

- Douglas Creek diversions only.
- Little Snake Reservoir not included.
- All improvements beyond Standard Creek eliminated.
  Plus additional 25 miles of pipeline across Saratoga Valley.
  Little Snake Reservoir and expansion of Rob Roy eliminated.

## E. DESCRIPTION OF ALTERNATIVES

- 1. Alternative A: NO ACTION (See Figure VII-1)
  - a. General Discussion. With this Alternative a permit would not be issued. The City of Cheyenne would continue to operate, as in the past, from their Stage I facility and from wells in Laramie County. Everything would remain in a status quo situation.







- 2. Alternative B: PERMIT PROPOSED FACILITIES WITH MODIFICATION. (See Figure VII-2)
  - a. <u>General Discussion</u>. This alternative would allow all the proposed facilities but with specified mitigation stipulations.

Alternative B proposes the development of Douglas Creek water for delivery to the Pole Mountain area with replacement water furnished by facilities on the Little Snake, as has historically been the case in Stage I. The potential average annual yield from the proposed Douglas Creek drainage facilities is approximately 28,100 acre-feet (Banner Supplemental Information 1979). A comprehensive outline of available supplies from Douglas Creek is presented in the 1976 Banner Report on Proposed Expansion of Cheyenne's Douglas Creek Facilities.

The potential yield of the existing Stage I facilities in the Douglas Creek drainage is approximately 13,000 acre-feet per year. Currently 7,400 acre-feet are being used. It is proposed that diversion and storage facilities in the Douglas Creek drainage would be enlarged and expanded to increase the average annual Douglas Creek yield to 27,500 acre-feet. The west slope collection facilities, sized to produce an average annual yield of 27,500 acre-feet, would convey west slope water through the transcontinental divide tunnel and into Hog Park Reservoir.

A detailed analysis of the water supplies available from an expansion of the Little Snake diversion system is presented in the Banner 1976 Report on Proposed Expansion of Cheyenne's Little Snake Diversion facilities.

## b. Detailed Discussion

1) Stage II Little Snake Diversion Pipeline Diversion structures would be constructed on
Rose Creek, Harrison Creek, Deadman Creek,
Solomon Creek, West Branch North Fork Little
Snake, Roaring Fork Little Snake, and several
smaller tributary streams in the Little Snake
drainage. These facilities would divert

runoff from 12,570 acres of watershed for an additional west slope potential water yield of about 20,100 acre-feet. This yield could be potentially available while providing the maintenance and flushing flows recommended (Table VII-3, Appendix VII). A diversion pipeline system would begin at the west portal of the transcontinental divide tunnel and be contructed westerly and southerly to the diversion structures. The pipelines would total approximately 151,000 feet in length and have a gravity flow capacity of 281 cubic feet per second from the west segment and 42 cubic feet per second from the south segment. Pipeline sizes would be 66 inches and 36 inches in diameter respectively (Banner Supplemental Information 1979). In addition, 22.7 miles of access road would be required for construction and maintenance. The roads would be located so that the road and pipeline would occupy the same route.

- 2) Stage II Hog Park Drop A pipeline from the east tunnel portal would be constructed to the backwaters of Hog Park Reservoir, paralleling the existing Pipeline. This pipeline would be approximately 6,500 feet in length and have a gravity flow capacity of 255 cubic feet per second (Banner Supplemental Information 1979).
- Stage II Hog Park Reservoir Enlargement -3) The existing Hog Park Reservoir on Hog Park Creek would be enlarged from 2970 acre-feet to a capacity of approximately 29,300 acre-feet. This enlargement would raise the existing earthfill dam 60 feet, resulting in a high water elevation in the reservoir of 8,640 feet increasing the reservoir from 175 to 695 acres. The reservoir would impound the water from the west slope and provide an average annual replacement water release of 27,500 acre-feet. Replacement of 3.0 miles of road would be required along the shoreline to provide access to the west slope collection facilities. Relocation of the facilities at Lakeview Campground plus a new access road would be required.

4) Stage II Rob Roy Reservoir Enlargement The existing Rob Roy Reservoir on Douglas Creek
would be enlarged from 8,895 acre-feet to a
capacity of approximately 35,400 acre-feet.
This enlargement would require raising the
existing earthfill dam 50 feet, resulting in a
high water elevation of 9,470 feet and
increasing the lake size from 314 to 800 acres.
The reservoir would impound runoff from 20.8
square miles of the upper Douglas Creek
watershed and could maintain an average annual
yield of 20,250 acre-feet (Banner Supplemental
Information 1979).

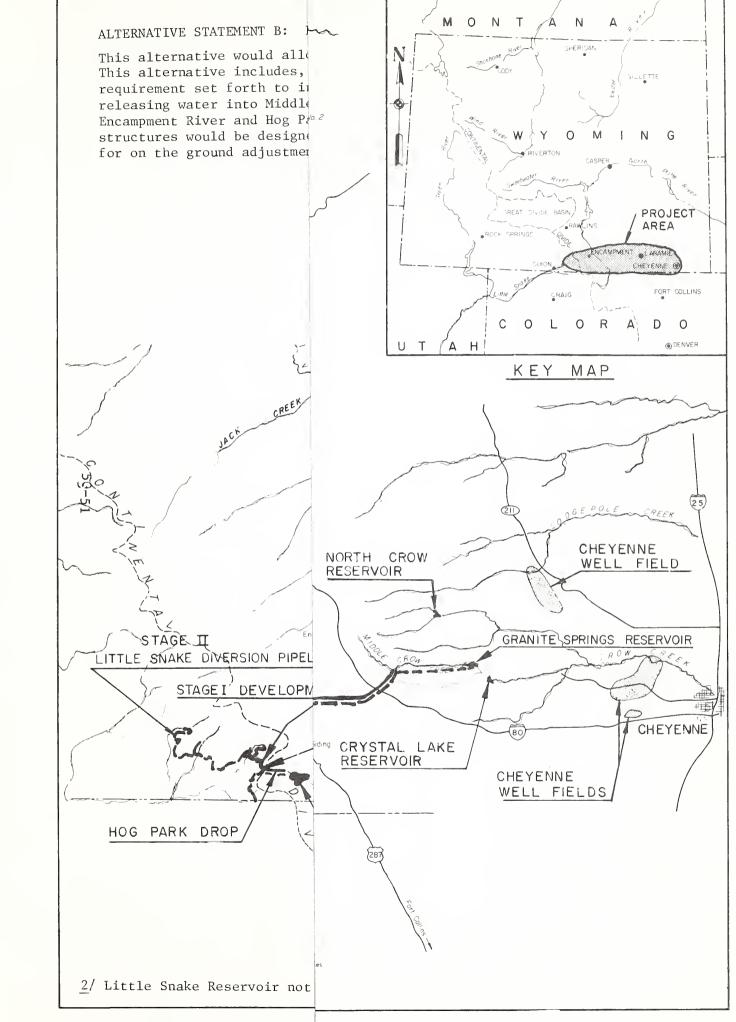
This yield would be available and provide the required maintenance flow below the Douglas Creek diversion structure (Table 3 Appendix VII). The proposed high water line of 9,470 feet would cover an additional 487 acres of land. A road 3.9 miles long would be constructed along the shoreline to provide access around the reservoir. The existing boat ramp and campground would be relocated above the new high water line.

Stage II Douglas Creek Area System - Increased capacity would be required to convey Douglas Creek water to Lake Owen. A pipeline would be constructed starting at the Douglas Creek diversion structure, paralleling the existing Stage I pipeline using the existing right-of-way and ending at Lake Owen Reservoir. The pipeline would be approximately 58,200 feet in length and have a gravity flow capacity of 23 cubic feet per second (Banner Supplemental Information 1979).

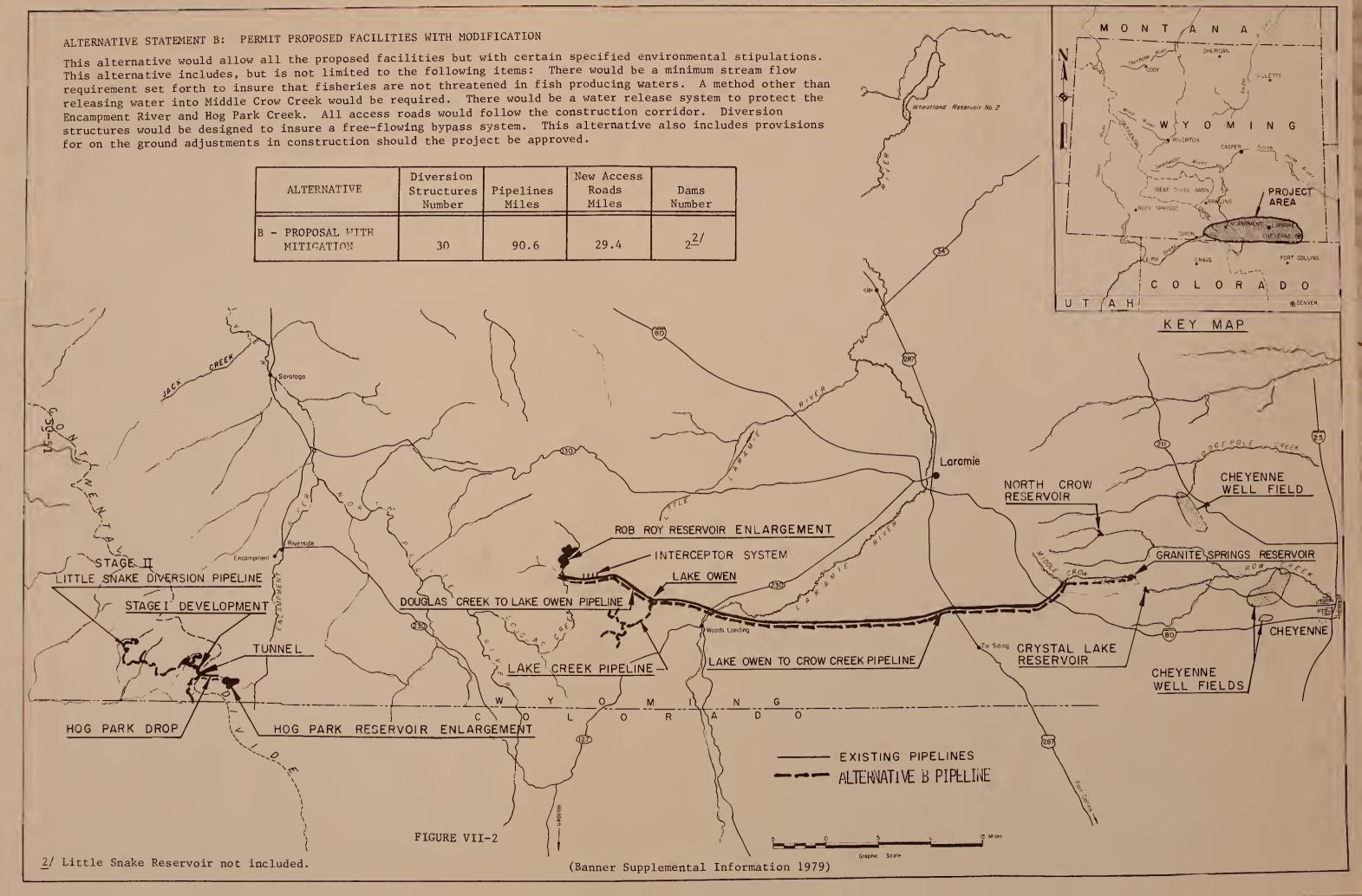
The existing Horse Creek diversion would produce an average annual yield of about 1500 acre-feet. Several additional small instream diversion structures would be constructed on North Branch Muddy Creek, East Branch Camp Creek, Middle Branch Camp Creek, Camp Creek, Beaver Creek, Nugget Gulch Branch of Beaver Creek, Gold Crater Creek, and Podunk Creek, all tributaries of Douglas Creek. The new collectors would gather runoff from 1,380 acres of watershed above the Douglas Creek to Lake Owen Pipeline and would yield an average of about 1,900

- acre-feet per year. Approximately 9,100 feet of pipeline would be needed to convey the collected runoff by gravity to the existing Douglas Creek-Lake Owen Pipeline (Banner Supplemental Information 1979).
- 6) Stage II Lake Creek System - Diversion structures and pipelines would be constructed to divert water from Lake Creek, Hay Creek, East Branch Hay Creek, West Branch Hay Creek, Joe Creek, H.T. Creek, Banner Creek, and Lincoln Gulch Creek, all tributaries of Douglas Creek. structures would divert runoff from 3,170 acres of the Lake Creek watershed for an average annual yield of 4,450 acre-feet. The collected water would be delivered to Lake Owen by gravity flow through approximately 73,500 feet of pipeline having a capacity of 30 cubic feet per second. An access road 6.6 miles long would be required for construction and maintenance. The roads, with rights-of-way varying from thirty to seventy feet in width, would be located so that the road and pipeline would occupy the same right-of-way to reduce the total disturbed area (Banner Supplemental Information 1979).
- An additional pipeline would be required to convey water from Lake Owen to Pole Mountain, Crystal Reservoir, and Granite Reservoir.

  This pipeline would be built, commencing at Lake Owen, crossing the Laramie River Valley, paralleling the existing pipeline on the existing right-of-way and terminating at the east boundary of the Medicine Bow National Forest on Pole Mountain. The pipeline would be approximately 233,000 feet in length with a gravity flow capacity of 26 cubic feet per second.







- 3. Alternative C: MODIFY STAGE I COLLECTION SYSTEM TO INCREASE CAPACITY AND EXTEND THE PROPOSED SYSTEM TO THE VICINITY OF WEST BRANCH OF THE NORTH FORK LITTLE SNAKE RIVER. (See Figure VII-3)
  - a. General Discussion. This alternative responds to the concerns about the possibility of extensive environmental damage. It is estimated that although the existing system collects 7,400 acre-feet, this may not be all of the permitted water available during the heavy runoff period. Modification would include redesign of the diversion structures to improve the bypass and collection plus enlargement of the pipe. There would be additional pipe in the same right-of-way as Stage I. The pipeline would be needed to carry the extra volume and would be in a previously disturbed area. Additional collection area would extend to the vicinity of the West Branch of the North Fork of the Little Snake River.

Alternative C would involve the development of the Douglas Creek water for transmission of 21,500 acrefeet to the Pole Mountain area. The west slope facilities (Little Snake River) would be designed to collect an approximate total of 21,500 acre-feet a year (Appendix VIII Section 1 Watershed). This water would pass through the transcontinental divide tunnel and into Hog Park Reservoir.

# b. Detailed Discussion.

1) Stage II Little Snake Diversion Pipeline -Diversion structures would be constructed on Rose Creek, Harrison Creek, Deadman Creek, Solomon Creek, West Branch North Fork Little Snake, and several smaller tributary streams in the Little Snake drainage. These facilities will divert runoff from 10,800 acres of watershed for an additional west slope water yield of about 16,000 acre-feet (Appendix VIII Section 1 Watershed). This yield could be available while providing the maintenance and flushing flows recommended (Table 3 Appendix VII). A diversion pipeline system would begin at the west portal of the transcontinental divide tunnel and be constructed westerly and southerly to the diversion structures. The pipelines would total approximately 116,700 feet in length and have a gravity flow capacity of 268 cubic feet per second from the west segment and 64 cubic feet per second from the

south segment. Pipeline sizes would be 72 inches and 41 inches in diameter respectively (Banner Supplemental Information 1979). In addition, 16.0 miles of access road would be required for construction and maintenance. The roads would be located so that the road and pipeline would occupy the same route.

- 2) Stage II Hog Park Drop A pipeline from the east tunnel portal would be constructed to the backwaters of Hog Park Reservoir, paralleling the existing Hog Park Drop Pipeline. This pipeline would be approximately 6,500 feet in length and have a gravity flow capacity of 255 cubic feet per second (Banner Supplemental Information 1979).
- 3) Stage II Hog Park Reservoir Enlargement -The existing Hog Park Reservoir on Hog Park Creek would be enlarged from 2,970 acre-feet to a capacity of approximately 29,300 acre-feet. This enlargement would raise the existing earthfill dam 60 feet, resulting in a high water elevation in the reservoir of 8,640 feet. This would increase the lake size from 175 to 695 acres. The reservoir would impound the water from the west slope and provide an average annual replacement water release of 21,500 acre-feet (Appendix VIII Section 1 Watershed). A replacement road 3.0 miles long would be required along the shoreline to provide access to the west slope collection facilities. Relocation of the facilities at Lakeview Campground plus a new access road would be required.
- 4) Stage II Rob Roy Reservoir Enlargement The existing Rob Roy Reservoir on Douglas Creek would be enlarged from 8,895 acre-feet to a capacity of approximately 35,400 acre-feet. This enlargement would require raising the existing earthfill dam 50 feet, resulting in a high water elevation of 9,470 feet. This would increase the reservoir size from 314 to 800 acres. The reservoir would impound runoff from 20.8 square miles of the upper Douglas Creek watershed and could maintain an average annual yield of 20,250 acre-feet (Banner Supplemental Information 1979). This yield

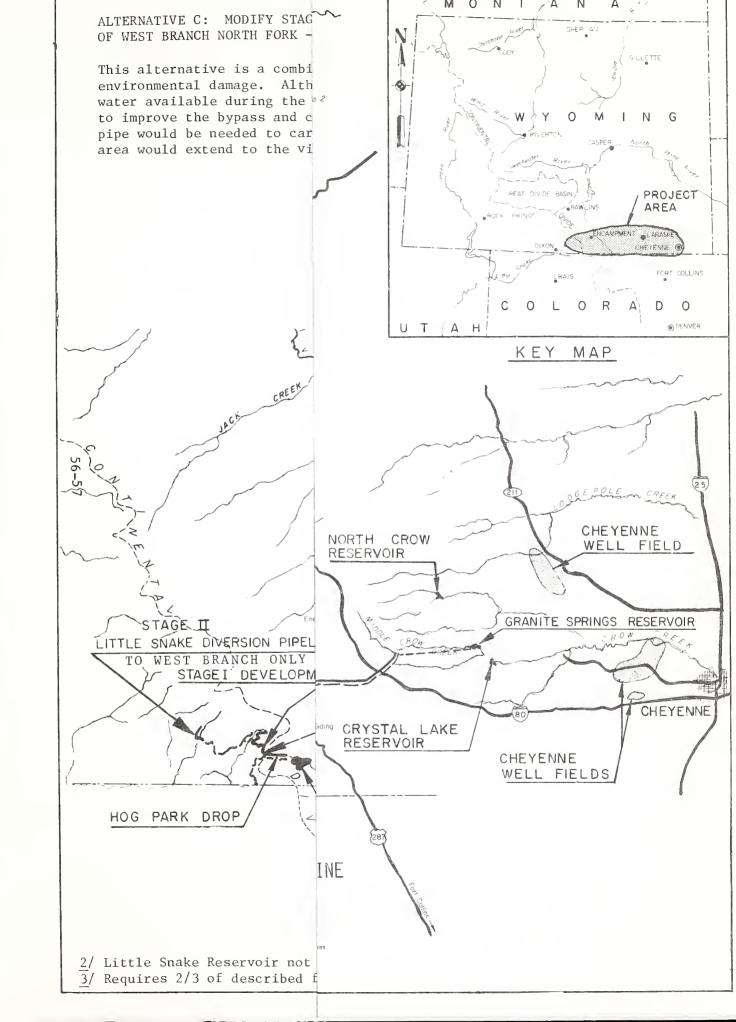
would be available and provide the required maintenance flow below the Douglas Creek diversion structure (Table VII-3 Appendix VII). The proposed high water line of 9,470 feet elevation would cover an additional 487 acres of land. A road 3.9 miles long would be constructed along the shoreline to provide access around the reservoir. The existing boat ramp and campground would be relocated above the new high water line.

5) Stage II Douglas Creek Area System - Increased capacity would be required to convey Douglas Creek water to Lake Owen. A pipeline would be constructed starting at the Douglas Creek diversion structure, paralleling the existing Stage I pipeline using the existing right-of-way and ending at Lake Owen Reservoir. The pipeline would be approximately 58,200 feet in length and have a gravity flow capacity of 23 cubic feet per second (Banner Supplemental Information 1979).

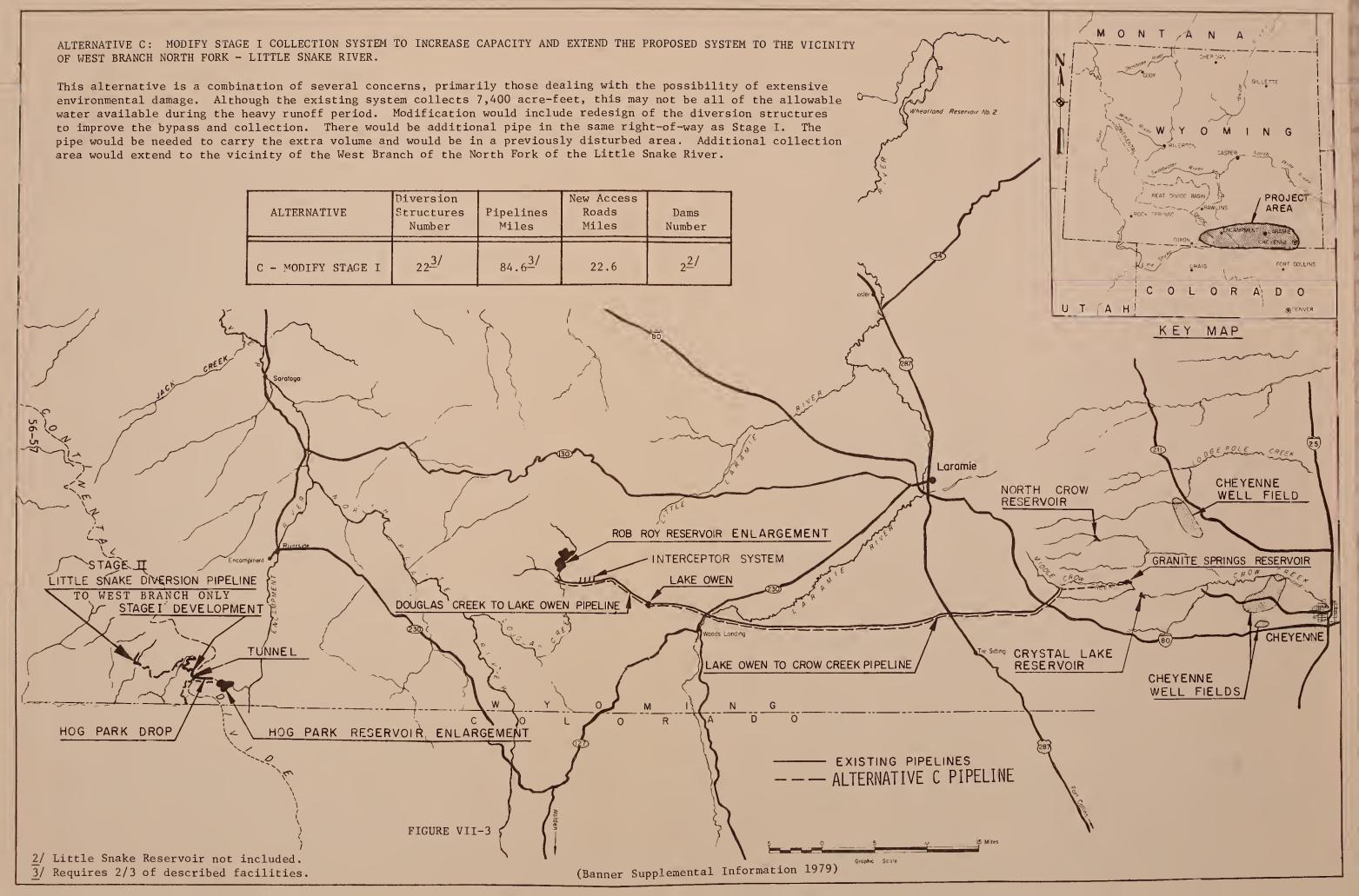
The existing Horse Creek diversion would produce an average annual yield of about 1500 acre-feet. Several additional small instream diversion structures would be constructed on North Branch Muddy Creek, East Branch Camp Creek, Middle Branch Camp Creek, Camp Creek, Beaver Creek, Nugget Gulch Branch of Beaver Creek, Gold Crater Creek, and Podunk Creek, all tributaries of Douglas Creek. The new collectors would gather runoff from 1,380 acres of watershed, above the Douglas Creek to Lake Owen Pipeline. They would yield an average of about 1,900 acre-feet per year. Approximately 9,100 feet of pipeline would be needed to convey the collected runoff by gravity to the existing Douglas Creek-Lake Owen Pipeline, then into Lake Owen (Banner Supplemental Information 1979).

6) Stage II Lake Creek System - It is doubtful that this system would be constructed under this alternative. The existing Douglas Creek facilities would produce all the water necessary to equal the water paid back by the Little Snake collection system.

7) Lake Owen - Pole Mountain System An additional pipeline would be required to convey water from Lake Owen to Pole Mountain, Crystal Reservoir, and Granite Reservoir. This pipeline would be built, starting at Lake Owen, crossing the Laramie River Valley, paralleling the existing pipeline on the existing rightofway and ending at the east boundary of the Medicine Bow National Forest on Pole Mountain. The pipeline would be approximately 233,000 feet in length with a gravity flow capacity of 26 cubic feet per second.









- 4. Alternative D: CONSTRUCT A RESERVOIR LOWER IN THE NORTH OR MIDDLE FORK BRANCHES OF THE LITTLE SNAKE RIVER AND PUMP WATER INTO THE EXISTING SYSTEM. (See Figure VII-4)
  - General Discussion. This alternative would change a. the concept of the project. A reservoir would be constructed on the North Fork of the Little Snake River below the confluence of the West Branch. It would impound stream water during the high runoff period. This reservoir would provide an average annual yield for Cheyenne, of 20,100 acre-feet. This, combined with the Stage I yield, would enable the Douglas Creek diversion to produce 27,500 acrefeet per year. A pumping station at the Little Snake Reservoir would deliver water through a transmission pipeline to the west portal of the transcontinental divide tunnel. From the west portal, water would flow by gravity through the tunnel and into Hog Park Reservoir. There would be no need to construct the Little Snake diversion pipeline system.

### b. Detailed Discussion.

1) Little Snake Reservoir - A dam would be constructed on the North Fork of the Little Snake River approximately one-half mile north of the Colorado state line. The reservoir maximum water surface would be at an elevation of approximately 7,545 feet. The storage volume would be about 33,000 acre-feet. The reservoir would impound runoff from the North Fork and the West Branch of the North Fork of the Little Snake River, from a watershed area of 45 square miles. A 325 foot high earthfill or rockfill dam would be required to obtain a high water level of 7,545 feet at this site. The proposed high water level would cover about 400 acres of land (Banner Supplemental Information 1979). Based on preliminary soil surveys and geologic formations within the reservoir area this location does not appear to be a suitable site.

2) Little Snake River Pipeline and Pump Station -A high pressure pipeline beginning at the pumping station would be required to convey Little Snake replacement water to the west portal of the existing transcontinental divide tunnel. The pipeline would be approximately 38,200 feet in length and have a capacity of 65 cubic feet per second. This pumping system would operate approximately six months a year, only during the snow free season. A new access road 8.8 miles long would be constructed to the reservoir, pump station, and pipeline for construction and maintenance. The roads would be located so that the road and pipeline would occupy the same route. Additional right-of-way would be needed for power facilities.

A 42 million gallon per day pumping station at the Little Snake Reservoir would be required to lift the water from the reservoir to the tunnel. It would be located upstream of the dam. This station would pump water from the reservoir and discharge into the west portal of the transcontinental divide tunnel. The pumping station would be sized to deliver 20,100 acre-feet of water. The pumping head would average about 1,650 feet (Banner Supplemental Information 1979).

- 3) Stage II Hog Park Drop A pipeline from the east tunnel portal would be constructed to the backwaters of Hog Park Reservoir, paralleling the existing Hog Park Drop Pipeline. This pipeline would be approximately 6,500 feet in length and have a gravity flow capacity of 65 cubic feet per second.
- Stage II Hog Park Reservoir Enlargement The existing Hog Park Reservoir on Hog Park
  Creek would be enlarged from 2,970 acre-feet
  to a capacity of approximately 29,300 acre-feet.
  This enlargement would raise the existing
  earthfill dam 60 feet, resulting in a high
  water level in the reservoir of 8,640 feet
  elevation. This would increase the reservoir
  from 175 to 695 acres. The reservoir would
  impound the water from the west slope and provide
  an average annual replacement water release of

27,500 acre-feet. A relocated road 3.0 miles long would be required along the shoreline to provide access to the west slope collection facilities. Relocation of the facilities at Lakeview Campground plus a new access road would be required.

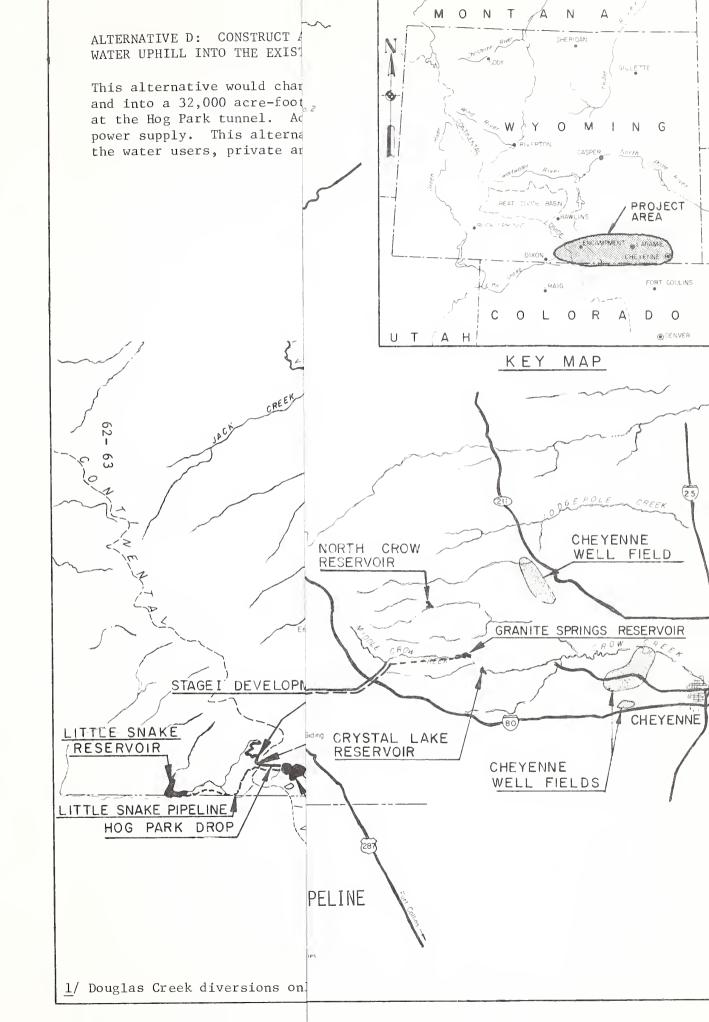
Stage II Rob Roy Reservoir Enlargement -The 5) existing Rob Roy Reservoir on Douglas Creek would be enlarged from 8,895 acre-feet to a capacity of approximately 35,400 acre-feet. This enlargement would require raising the existing earthfill dam 50 feet, resulting in a high water elevation of 9,470 feet. This would increase the reservoir size from 314 acres to 800 acres. The reservoir would impound runoff from 20.8 square miles of the upper Douglas Creek watershed and could maintain an average annual yield of 20,250 acre-feet (Banner Supplemental Information 1979). This yield would be available and would provide the required maintenance flow below the Douglas Creek diversion structure (Table VII-3 Appendix VII).

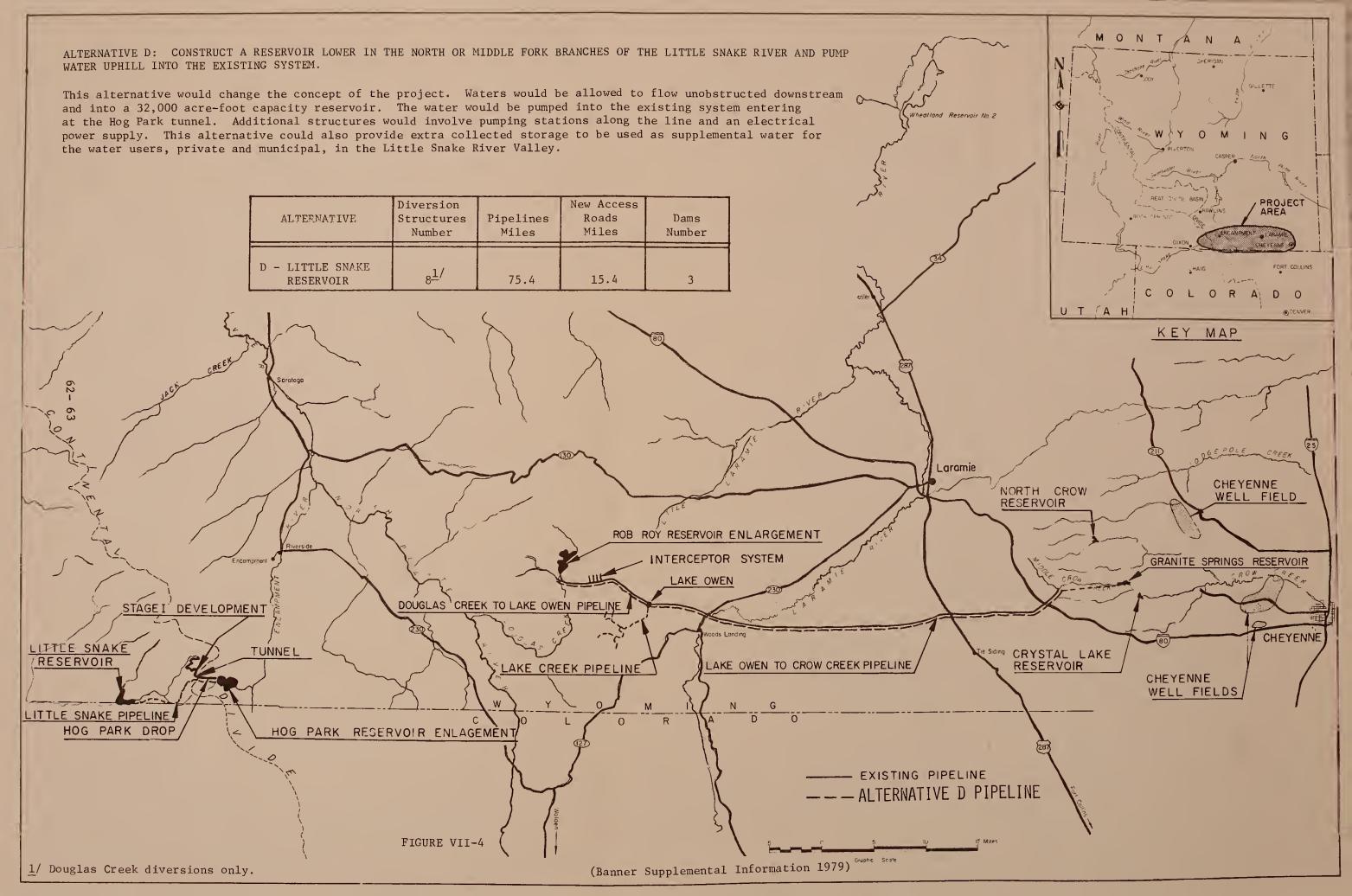
The proposed high water line of 9,470 feet would inundate 487 acres of land. Additionally, a relocated road 3.9 miles long would be constructed along the shoreline to provide access around the reservoir. The existing boat ramp and campground would be relocated above the new high water line.

6) Stage II Douglas Creek Area System -Increased capacity would be required to convey Douglas Creek water to Lake Owen. A pipeline would be constructed starting at the Douglas Creek diversion structure, paralleling the existing Stage I pipeline using the existing right-of-way and ending at Lake Owen Reservoir. The pipeline would be approximately 58,200 feet in length and have a gravity flow capacity of 23 cubic feet per second (Banner Supplemental Information 1979).

The existing Horse Creek diversion would produce an average annual yield of about 1500 acrefeet. Several additional small instream diversion structures would be constructed on North Branch Muddy Creek, East Branch Camp Creek, Middle Branch Camp Creek, Camp Creek, Beaver Creek, Nugget Gulch Branch of Beaver Creek, Gold Crater Creek, and Podunk Creek, all tributaries of Douglas Creek. The new collectors would gather runoff from 1,380 acres of watershed above the Douglas Creek to Lake Owen Pipeline. They would yield an average of about 1,900 acre-feet per year. Approximately 9,100 feet of pipeline would be needed to convey the collected runoff by gravity to the existing Douglas Creek to Lake Owen Pipeline, then into Lake Owen (Banner Supplemental Information 1979).

- 7) Stage II Lake Creek System - Diversion structures and pipelines would be constructed to divert water from Lake Creek, Hay Creek, East Branch Hay Creek, West Branch Hay Creek, Joe Creek, J. T. Creek, Banner Creek, and Lincoln Gulch Creek, all tributaries of Douglas Creek. These structures would divert runoff from 3,170 acres of the Lake Creek watershed for an average annual yield of 4,450 acre-feet. collected water would be delivered from the collectors to Lake Owen by gravity flow through approximately 73,500 feet of pipeline having a capacity of 30 cubic feet per second. An access road 11.9 miles long would be required for construction and maintenance thereafter. The roads and pipeline would occupy the same route.
- An additional pipeline would be required to convey water from Lake Owen to Pole Mountain, Crystal Reservoir, and Granite Reservoir. This pipeline would be built, starting at Lake Owen, crossing the Laramie River Valley, paralleling the existing pipeline on the existing right-of-way, and ending at the east boundary of the Medicine Bow National Forest on Pole Mountain. The pipeline would be approximately 233,000 feet in length with a gravity flow capacity of 26 cubic feet per second.





- 5. Alternative E: PUMP FROM HOG PARK RESERVOIR TO ROB ROY RESERVOIR. (See Figure VII-5)
  - General Discussion. This alternative proposes a. to transport water directly from its west slope source to Cheyenne rather than use west slope water for replacement. This involves the expansion of the Little Snake collection facilities to collect an additional 20,100 acre-feet per year. Improvements would include extension of the existing system of diversion and conveyance pipelines to pick up Little Snake tributaries, construction of Hog Park Drop pipeline and enlargement of Hog Park Reservoir. Flows released from Hog Park Reservoir would be pumped through a pipeline to be constructed from Hog Park Reservoir to Rob Roy Reservoir and/or Lake Owen.

Under this alternative, the existing facilities on Douglas Creek would be used to produce their maximum potential of 13,000 acre-feet per year. There would be no enlargement of the existing facilities. In order to use the maximum potential of the existing Douglas Creek facilities (13,000 acre-feet per year) it would be necessary to release an equal amount of water into the North Platte system from the Little Snake diversion project. The present rate of releases, which have averaged 7,400 acre-feet per year, would have to be supplemented with an additional release of 5,600 acre-feet per year. This 5,600 acre-feet would come from the expansion of the system described above and would reduce the total quantity available from 20,100 to 14,500 acre-feet per year.

## b. Detailed Description

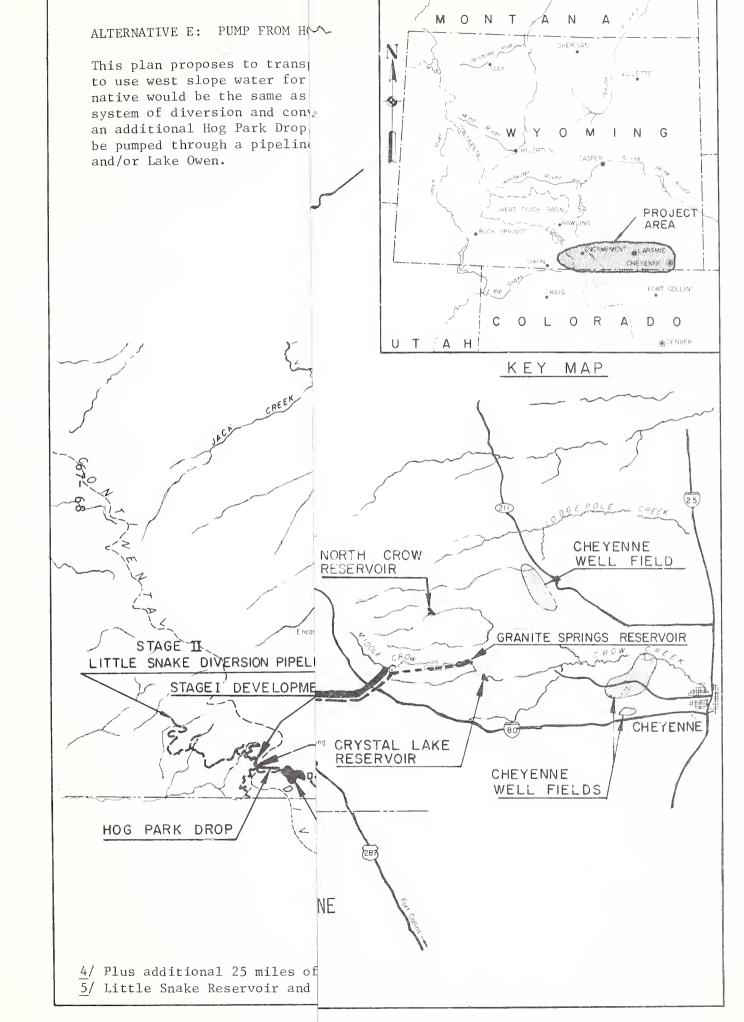
1) Stage II Little Snake Diversion Pipeline Diversion structures would be constructed on
Rose Creek, Harrison Creek, Deadman Creek,
Solomon Creek, West Branch North Fork Little
Snake, Roaring Fork Little Snake, and several
smaller tributary streams in the Little Snake
drainage. These facilities would divert runoff
from 12,570 acres of watershed for an additional
potential west slope water yield of about 20,100
acre-feet. This yield is potentially available
while providing the maintenance and flushing
flows recommended (Table VII-3 Appendix VII).

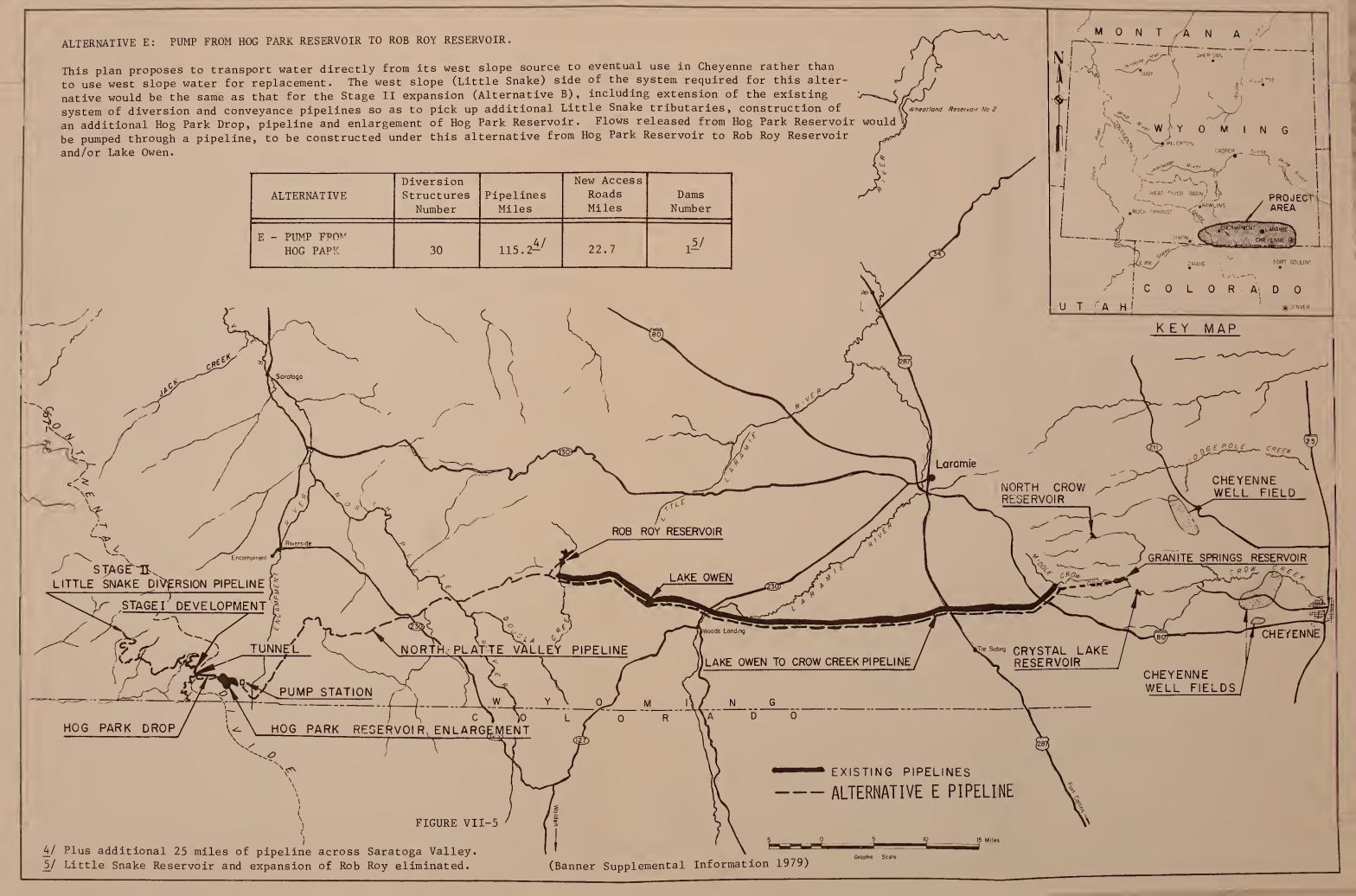
Two diversion pipelines would begin at the west portal of the transcontinental divide tunnel and be constructed westerly and southerly to the diversion structures. The pipelines would total approximately 151,000 feet in length and have a gravity flow capacity of 281 cubic feet per second from the west segment and 42 cubic feet per second from the south segment. In addition, 22.7 miles of access road would be required for construction and maintenance. The roads and pipeline would occupy the same route.

- 2) Stage II Hog Park Drop Pipeline A pipeline from the east tunnel portal would be constructed to the backwaters of Hog Park Reservoir, paralleling the existing Hog Park Drop Pipeline. This pipeline would be approximately 6500 feet in length and have a gravity flow capacity of 255 cubic feet per second.
- 3) Stage II Hog Park Reservoir Enlargement - The existing Hog Park Reservoir on Hog Park Creek would be enlarged from 2,970 acre-feet to a capacity of approximately 29,300 acrefeet. This enlargement would raise the existing earthfill dam 60 feet, resulting in a high water level in the reservoir of 8,460 feet. This would increase the reservoir size from 175 to 695 acres. The reservoir would impound the water from the west slope and provide an average annual replacement water release of 27,500 acre-feet. A relocated road 3.0 miles long would be required along the shoreline to provide access to the west slope collection facilities. Relocation of the facilities and access road at Lakeview Campground would be required.
- 4) Hog Park Creek To Douglas Creek Pipeline, Pump Station, and Booster Station - A pipeline would be constructed starting at the pumping station on Hog Park Reservoir Road, going easterly across the North Platte River Valley to Douglas Creek, paralleling the Boat Creek Road. From the Douglas Creek area, the pipeline would branch to allow water to be pumped into either the existing Rob Roy Reservoir or into Lake Owen. The pipeline to Rob Roy Reservoir would allow the use of the existing Rob Roy Reservoir for storage. The pipeline would be approximately 263,000 feet in length and have a capacity of 40 cubic feet per second. The pipeline would follow the alignment of existing roads to reduce the amount of disturbed area.

A 26 million gallon per day pumping station at Hog Park Reservoir, located upstream of the dam, would be required to lift the water from the reservoir, over high ground near Blackhall Mountain, and into the North Platte River Valley. A 26 million gallon per day booster station would be constructed east of the North Platte River to lift water into the Douglas Creek basin. The pumping station and booster station would be sized to deliver 14,500 acrefeet of water into Lake Owen. The pumping head for the pump and booster station would average 1,425 and 1,095 feet, respectively, or a total pumping head of 2520 feet.

5) Stage II Lake Owen - Pole Mountain System - An additional pipeline would be required to convey water from Lake Owen to Pole Mountain, Crystal Reservoir, and Granite Reservoir. This pipeline would start at Lake Owen, cross the Laramie River Valley, parallel the existing pipeline on the existing right-of-way, and end at the east boundary of the Medicine Bow National Forest on Pole Mountain. The pipeline would be approximately 233,000 feet in length with a gravity flow capacity of 26 cubic feet per second.







- 6. Alternative F: PUMP FROM NORTH PLATTE RIVER AT BOAT CREEK CONFLUENCE TO ROB ROY RESERVOIR. (See Figure VII-6)
  - a. General Discussion. This alternative proposes construction of a pump station and pressure pipeline to transport water supplies from the North Platte River to the existing Rob Roy Reservoir and/or Lake Owen. The intake structure for this pipeline would be located near the confluence of Boat Creek and the North Platte River.

Flows diverted from the North Platte River would be replaced with west slope flows diverted from the Little Snake River drainage. Construction of the Little Snake diversion pipeline and enlargement of Hog Park Reservoir would be required.

The existing Douglas Creek facilities would be utilized to produce the maximum potential of 13,000 acre-feet per year, and there would be no enlargement of these facilities.

The diversion would be designed to pump an average of 14,500 acre-feet per year via pipeline to Middle Crow Creek. The total water to Cheyenne would be 27,500 acre-feet per year.

The flow records of the USGS from the North Platte River at Saratoga, Wyoming (066270) indicate that the flow in the section of river between the proposed point of diversion at Boat Creek, and replacement point at the confluence of the Encampment River, is adequate to maintain senior water right appropriations between diversion and replacement, and still provide the 14,500 acre-feet per year for Cheyenne (Banner Supplemental Information 1979).

#### b. Detailed Discussion

1) Stage II Little Snake Diversion Pipeline Diversion structures would be constructed on
Rose Creek, Harrison Creek, Deadman Creek,
Solomon Creek, West Branch North Fork Little
Snake, Roaring Fork Little Snake, and several
smaller tributary streams in the Little Snake
drainage. These facilities would divert runoff
from 12,570 acres of watershed for an additional
west slope water yield of about 20,100 acre-feet.

This yield would be available while providing the maintenance and flushing flows recommended (Table VII-3 Appendix VII). A diversion pipeline system would begin at the west portal of the transcontinental divide tunnel and be constructed westerly and southerly to the diversion structures. The pipelines would total approximately 151,000 feet in length and have a gravity flow capacity of 281 cubic feet per second from the west segment and 42 cubic feet per second from the south segment. In addition 22.7 miles of access road would be required for construction and maintenance. The roads and pipeline would occupy the same route.

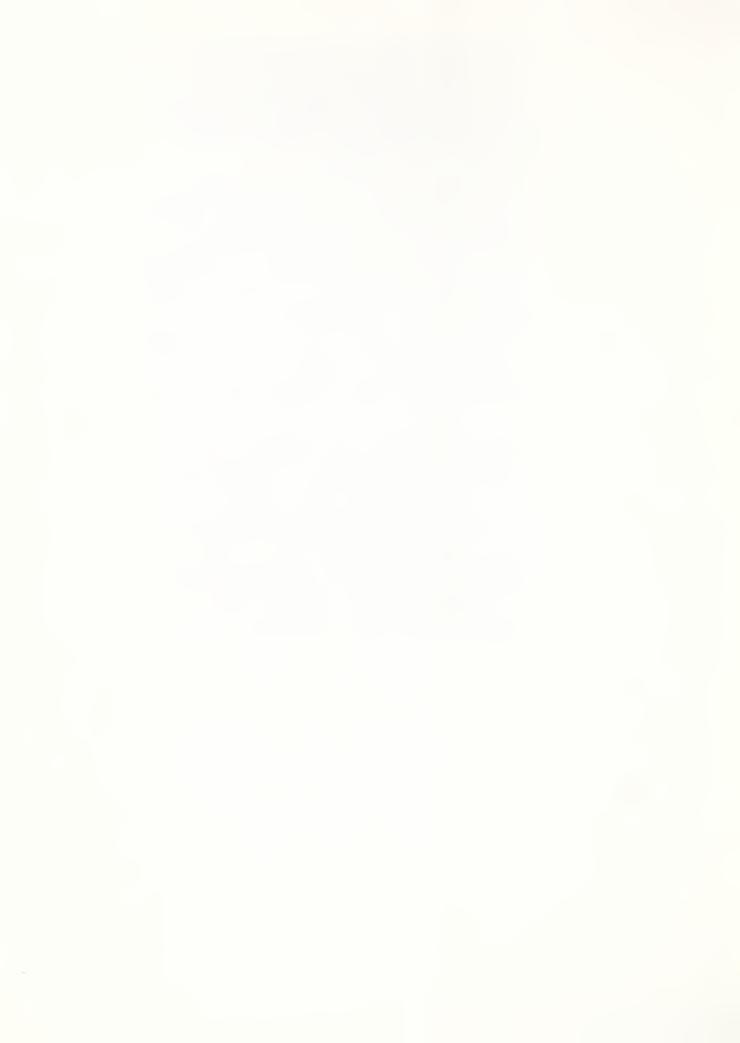
- 2) Stage II Hog Park Drop Pipeline A pipeline would be constructed from the east tunnel portal to the backwaters of Hog Park Reservoir, paralleling the existing Hog Park Drop Pipeline. This pipeline would be approximately 6,500 feet in length and have a gravity flow capacity of 255 cubic feet per second.
- 3) Stage II Hog Park Reservoir Enlargement -The existing Hog Park Reservoir on Hog Park Creek would be enlarged from 2,970 acre-feet to a capacity of approximately 29,300 acre-feet. This enlargement would raise the existing earthfill dam 60 feet, resulting in a high water level in the reservoir of 8,460 feet. This would increase the reservoir size from 175 to 695 acres. The reservoir would impound water from the west slope and provide an average annual replacement water release of 27,500 acre-feet. A relocated new road 3.0 miles long would be required along the shoreline to provide access to the west slope collection facilities. Relocation of the facilities and access road at Lakeview Campground would be required.
- A) North Platte River to Douglas Creek Pipeline and Pumping Station A pipeline would be constructed from the North Platte River near the mouth of Boat Creek. The pipeline would follow the Boat Creek Road to Douglas Creek, then parallel the existing Stage I Douglas Creek to Lake Owen Pipeline and discharge into Lake Owen. At Douglas Creek the pipeline would

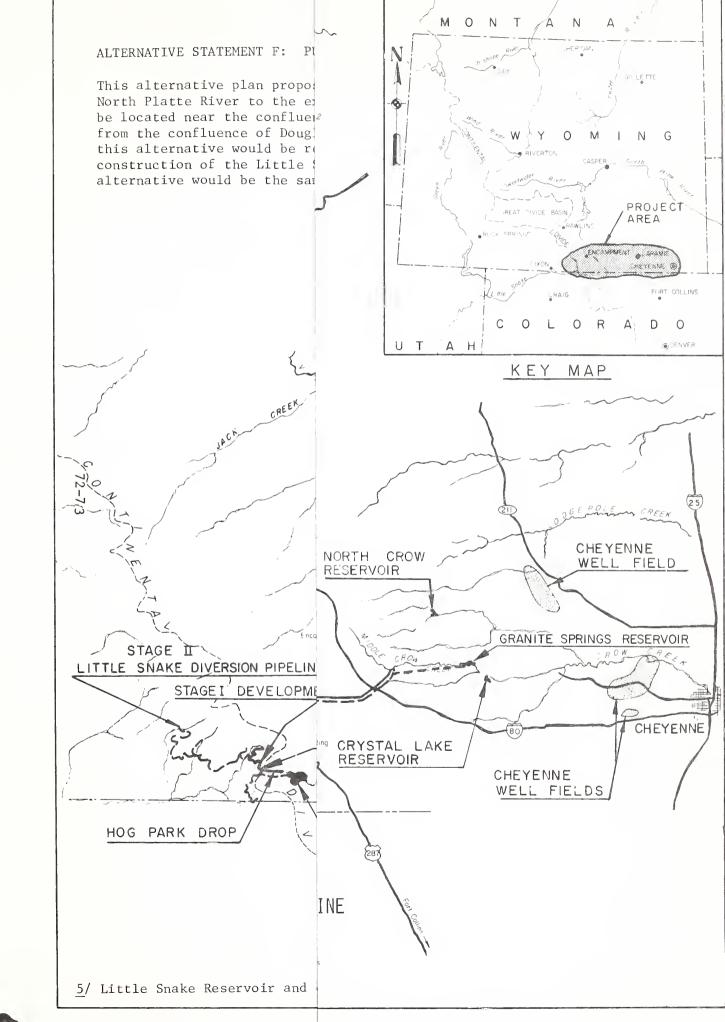
have a branch line to Rob Roy Reservoir. This would enable pumped water from the North Platte River to be delivered to the reservoir to use the existing storage capacity. The pipeline would be approximately 116,200 feet in length and have a flow capacity of 40 cubic feet per second.

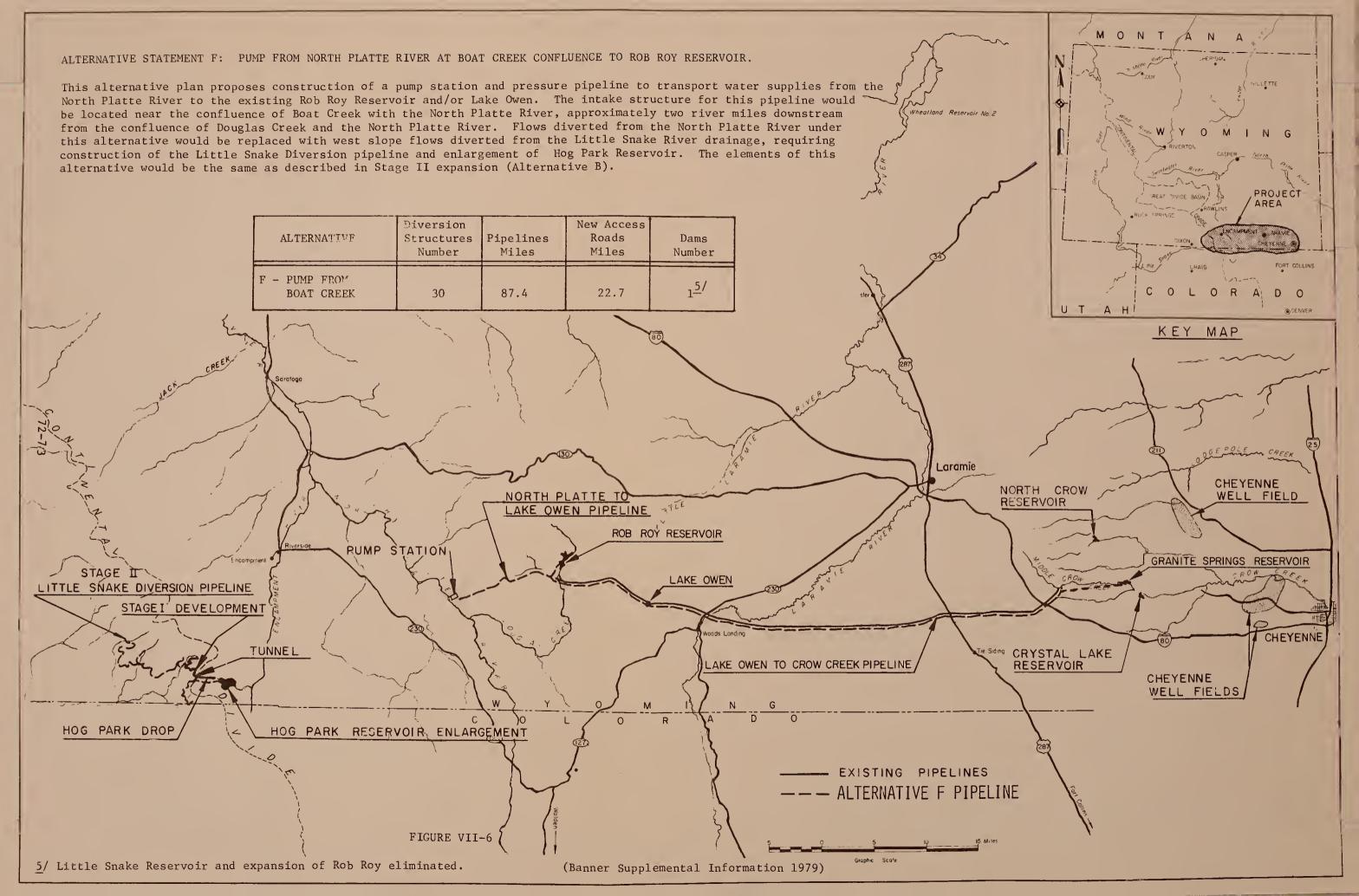
A 26 million gallon per day pumping station would be located on the North Platte River near the mouth of Boat Creek. This station would pump from an intake structure on the North Platte River and discharge into Rob Roy Reservoir or Lake Owen through a pipeline aforementioned. Two 26 million gallon per day booster stations would be located along the pipeline to lift the water from the North Platte River to Rob Roy Reservoir or Lake Owen. The pumping and booster station would be sized to deliver 14,500 acrefeet of water into Lake Owen. The total lift of 2,400 feet would be divided equally so that the pump station and each booster station would operate against an average head of 800 feet.

An additional pipeline would be required to convey water from Lake Owen to Pole Mountain, Crystal Reservoir and Granite Reservoir.

This pipeline would be built, starting at Lake Owen, crossing the Laramie River Valley, paralleling the existing pipeline on the existing right-of-way and ending at the east boundary of the Medicine Bow National Forest on Pole Mountain. The pipeline would be approximately 233,000 feet in length with a gravity flow capacity of 26 cubic feet per second.







,			

- 7. Alternative G: PUMP FROM NORTH PLATTE RIVER NEAR
  NORTHGATE COLORADO TO POLE MOUNTAIN. (See Figure VII-7)
  - a. General Discussion. This alternative proposes to construct a pump station and continuous pressure pipeline diverting water from the North Platte River near Northgate, Colorado and conveying it to Middle Crow Creek. This pipeline would follow the Colorado Highway 127 right-of-way Wyoming Highway 230 right-of-way to Woods Landing. This pipeline would run parallel to the existing Stage I Lake Owen to Middle Crow Creek gravity pipeline from Woods Landing to Pole Mountain.

Flows diverted from the North Platte River under this alternative would be replaced with west slope flows diverted from the Little Snake River drainage. It would require construction of the Little Snake Diversion Pipeline and enlargement of Hog Park Reservoir.

The existing Douglas Creek facilities would be utilized to produce the maximum potential of 13,000 acre-feet per year. There would be no enlargement of these facilities.

The diversion that would be constructed on the North Platte River near Northgate, Colorado, would be designed to pump an average of 14,500 acre-feet per year via pipeline to Middle Crow Creek. The total water to Cheyenne would be 27,500 acre-feet per year. All water diverted from the North Platte River or from the Douglas Creek drainage would be replaced by releases from the expanded Little Snake system with the corresponding capacity of 27,500 acre-feet per year.

The USGS stream flow records at the station near Northgate, Colorado (066200) indicate that the flow near the proposed diversion point has historically been adequate during the period of record (1916-present) to sustain a year-round pumping demand of 22 cubic feet per second and a nine month demand of 26 cubic feet per second.

1) Stage II Little Snake Diversion Pipeline Diversion structures would be constructed on
Rose Creek, Harrison Creek, Deadman Creek,
Solomon Creek, West Branch North Fork Little

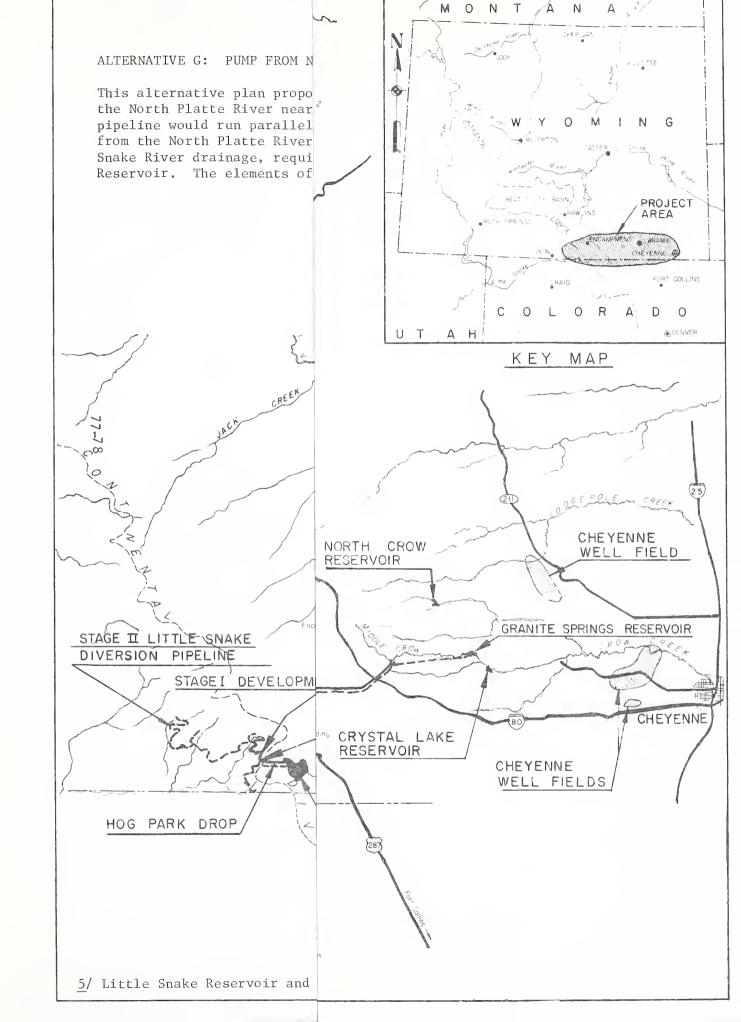
Snake, Roaring Fork Little Snake, and several smaller tributary streams in the Little Snake drainage. These facilities would divert runoff from 12,570 acres of watershed for an additional potential west slope water yield of about 20,100 acre-feet. This yield is potentially available while providing the maintenance and flushing flows recommended (Table 3 Appendix VII). A diversion pipeline system would begin at the west portal of the transcontinental divide tunnel and be constructed westerly and southerly to the diversion structures. The pipelines would total approximately 151,000 feet in length and have a gravity flow capacity of 281 cubic feet per second from the west segment and 42 cubic feet per second from the south segment. In addition, 22.7 miles of access road would be constructed and maintained. The roads would be located so the road and pipeline would occupy the same route.

- 2) Stage II Hog Park Drop Pipeline A pipeline would be constructed from the east tunnel portal to the backwaters of Hog Park Reservoir, paralleling the existing Hog Park Drop Pipeline. This pipeline would be approximately 6,500 feet in length and have a gravity flow capacity of 255 cubic feet per second.
- 3) Stage II Hog Park Reservoir Enlargement -The existing Hog Park Reservoir on Hog Park Creek would be enlarged from 2,970 acre-feet to a capacity of approximately 29,300 acre-feet. This enlargement would raise the existing earthfill dam 60 feet, resulting in a high water level of 8,460 feet. It would increase the reservoir size from 175 to 695 acres. The reservoir would impound water from the west slope and provide an average annual replacement water release of 27,500 acre-feet. A relocated road 3.0 miles long would be required along the shoreline to provide access to the west slope collection facilities. Relocation of the facilities at Lakeview Campground plus a new access road would be required.

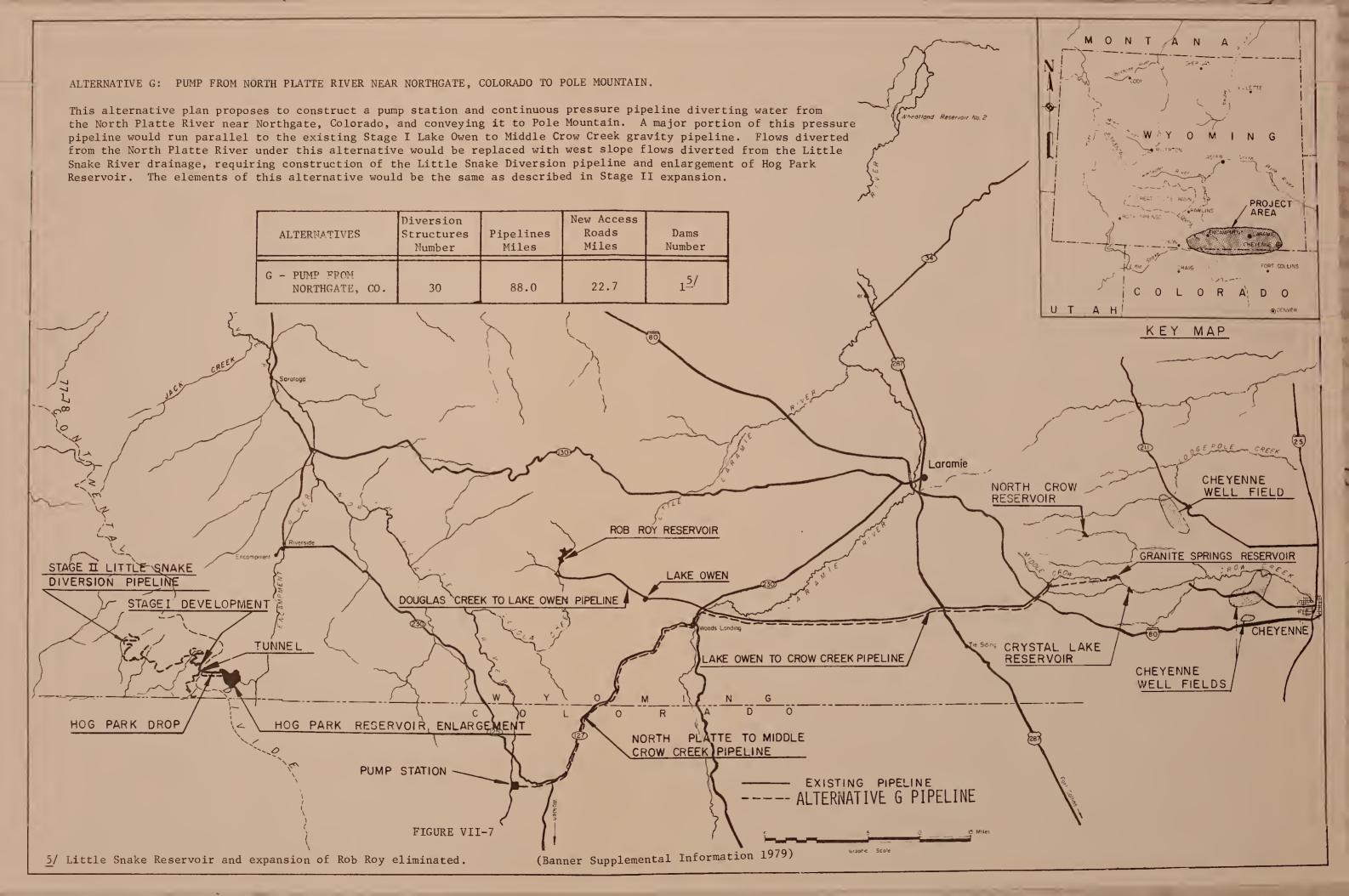
And Pumping Station - A pipeline from Northgate, Colorado, to Middle Crow Creek would be required. The pipeline would start at the pumping station, follow Wyoming Highway 230 to the existing Stage I Lake Owen to Middle Crow Creek pipeline crossing near Woods Landing, Wyoming; then parallel the existing Stage I pipeline and end on Pole Mountain. The pipeline would have a pressure dissipator to reduce the pipeline pressure through the sag across the Laramie Valley. The pipeline would have a length of approximately 352,000 feet and have a flow capacity of 26 cubic feet per second.

A 17 million gallon per day pumping station, located on the North Platte River near Northgate, Colorado, would be required to lift the water to Pole Mountain. Water would be diverted from the North Platte River through an intake structure. One 17 million gallon per day booster station would be required along the pipeline to lift the water into the Laramie Valley, where gravity flow would transfer the water down the pipeline past the east boundary of the Medicine Bow National Forest on Pole The pump and booster station would Mountain. operate year-round. The total lift of 1500 feet would be divided equally so that the pump and booster station would each operate against an average head of 750 feet.











# VIII. EFFECTS OF IMPLEMENTATION

CONTENTS																_	Page
Summary			•	•	•	•	•	•	•	•	•	•	•	•	•	•	80
Description of Effe	ects.	٠															82



# VIII. EFFECTS OF IMPLEMENTATION

# A. SUMMARY

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E	ALTERNATIVE F	ALTERNATIVE G
1. Economic Feasibility a. Amount of Water Delivered to Cheyenne Approximately 80% Collector Efficiency	7,400	27,500	21,500	27,500	27,500	27,500	27,500
b. Cost to the Consumer - Rate per 1000 gal. 1978 Dollars - Rate per acre-foot	\$.82	\$1.50	\$1.40	\$3.00	\$2.37	\$2.37	\$1.92
c. Cost to City - Rate per 1000 gal. 1978 Dollars - Rate per acre foot	\$.29	\$.66	\$.58 \$189	\$1.13	\$.91	\$.88	\$.77
d. Project Construction Cost 1978 Dollars		\$75,924,000	\$63,000,000	\$111,706,000	\$81,132,000	\$73,487,000	\$71,781,000
e. Annual Maintenance Cost - 1978 Dollars Does Not Include Annual Special Use Fee	\$50,000/yr	\$126,500/yr	\$113,900/yr	\$2,405,260/yr	\$2,409,310/yr	\$2,569,830/yr	\$1,654,880/yr
f. Forest Service Administrative Costs, Construction/Maintenance - 1978 Dollars	500	25,000	23,000	15,000	28,000	25,000	25,000
g. Electrical Power Consumed - Kilowatt Hours	14,700	14,700	14,700	33,320,000	33,350,150	35,879,850	22,424,850
Resource Management Concerns     a. Watershed     1) Riparian Habitat Altered	0	453 Ac	453 Ac	514 Ac	246 Ac	246 Ac	246 Ac
2) Salinity	0	1.73 mg/l	1.73 mg/1				
b. Fisheries 1) Game Species Existing	4	4	4	4	4	4	4
2) Trout Streams Diverted	0	13	11	4	9	9	9
3) Miles of Stream Inundated	0	9.7	9.7	14.6	5.8	5.8	5.8
4) Trout Habitat Units Lost	0	447	440	814	149	12,292	12,807
<ul> <li>c. Recreation</li> <li>1) Dispersed Recreation Change</li> <li>Semi-Primative to Rural</li> </ul>	0	8400 Ac	6300 Ac	2700 Ac	8400 Ac	8400 Ac	8400 Ac
Developed Recreation Sites     Displaced and Relocated	0	375 PAOT	375 PAOT	375 PAOT	185 PAOT	185 PAOT	185 PAOT
d. Wilderness Potential 1) Acres Available	67,322	62,112	65,892	67,322	62,112	62,112	62,112
2) Rating - Character Loss	0	-24	-9	-1	-28	-30	-28
e. Soils 1) Surface Disturbance	0	2580 Ac	2454 Ac	3079 Ac	1940 Ac	1777 Ac	1739 Ac
2) Mass Land Failure	0	720 Ac	150 Ac	740 Ac	900 Ac	800 Ac	830 Ac
Acres of Very Low Revegetation     Potential	0	590 Ac	320 Ac	500 Ac	900 Ac	512 Ac	680 Ac
f. Range - Grazing Capacity - AUM's Lost	0	-418	-414	<del>-</del> 455	-309	-268	-268
g. Terrestrial Wildlife 1) Game Species Existing	5	5	5	5	5	5	5
2) Acres of Habitat Lost	0	1007	1007	1907	520	520	520
3) Consumptive Use - User Days	1100	2700	2700	1300	2700	2700	2700
4) Nonconsumptive Use - User Days	100	300	300	120	300	300	300



	<b>Y</b>							
	ALTERNATIVE A	LTERNATIVE ALTERNATIVE ALT		ALTERNATIVE D	ALTERNATIVE E	ALTERNATIVE F	ALTERNATIVE G	
h. Threatened or Endangered Fish Species Present Downstream	2	2	2	2	2	2	2	
<ol> <li>Visual Resources - Acres of Outstanding Quality Altered</li> </ol>	0	493	493	493	493	493	493	
j. Tree Resource - Acres Loss	0	532	532	532	250	250	250	
k. Transportation - Roads, New Construction - Miles	0	29.4	22.6	15.4	22.7	22.7	22.7	
<ol> <li>Cultural Resources - Acres Needing Survey</li> </ol>	0	2380	2454	3079	1940	1777	1739	
3. State - County Plans a. State Plans 1) Meets Goals Land Plan	100	100	100	100	100	100	100	
2) Meets Goals Water Plan	0	100	87	100	100	100	100	
b. County Plans 1) Meets Goals Land Plan	10	100	100	100	100	100	100	
2) Meets Goals Water Plan	0	100	87	100	100	100	100	
3) Domestic Water Use	0	100	87	100	100	100	100	
4. Resolve Pulbic Issues a. Cheyenne Needs Water	Y NX	Y X N	Y X N	YX N	Y X N	Y X N	Y_X N	
b. Alternative Water Sources Considered	Y X N	Y_X N	Y X N	Y_X N	Y X N	Y_X N_	Y_X N	
c. Provide for Adequate Instream Flows	Y NX	Y X N	Y_X N	Y_X N	Y X N	Y_X N	Y X N	
d. Will Decrease Stream Flows Below Maintenance Level	Y NX	Y NX	Y NX	Y NX	Y N_X	Y NX	Y N_X	
e. Minimize Reservoir Fluctuation	Y X N	Y_X N	Y_X N	Y_X N	Y_X N	Y_X N	Y_X N	
f. Increase Colorado River Salinity	Y N_X	Y_X N	<u> Ү. х</u>	Y X N	Y_X N	Y_X N	Y_X N	
g. Provide New Access into Unroaded Areas	Y N_ <u>X</u>	Y X N	Y X N	Y_X N	Y_X N	Y_X N_	Y_X N	
h. Adversely Impact Sensitive Species Habitat	Y N X	Y NX	Y N X	Y N X	Y NX	Y N_X	Y N_X	
i. Provide an Adverse Effect on Downstream Users	Y N X	Y N_X	Y N_X	Y NX	Y N_X	Y N_X	Y NX	
j. Adversely Affect Threatened and Endangered Species	Y N_X	Y NX	Y NX	YN_X	Y N_X	Y N_X	Y N_X	

#### B. DESCRIPTION OF EFFECTS

#### 1. Alternative A - NO ACTION

# a. Economic Feasibility

This alternative would continue to supply Cheyenne with 7,400 acre-feet of water annually from the Stage I system. The only increase in costs to the City or the consumer would be those which could occur as system maintenance costs increase.

Based on 1978 dollars Cheyenne residents are paying \$.82 per 1,000 gallons or \$267 per acre-foot. The City cost is \$.29 per 1,000 gallons or \$95 per acre-foot. Annual maintenance costs are \$50,000. Approximately 14,700 kilowatts of electrical power are consumed in system maintenance.

Permit administration costs to the Forest Service would be \$500 for a routine annual inspection of facilities. Detailed inspections of dam sites are performed by the Army Corps of Engineers every five years. Annual inspections are done by Banner Engineering of Laramie. The Forest Service would participate.

# b. Resource Management Concerns

There would not be additional effects on turbidity or salinity within the Colorado River system. Inadequate stream flows in the streams diverted by Stage I would prevail with little or no opportunity to alter the situation.

Recreation opportunities would remain in current proportions with the exception of the 5,210~acre Area IV described in the Huston Park Land Management Plan. It would be recommended for wilderness along with Area I immediately to the north.

The dams, roads, pipeline and diversion structures would not be present and there would be no further reduction in the visual quality of the existing landscape. Areas not satisfactorily revegetated in Stage I would remain in their current state.

There would be no additional pipelines. The road system would remain at the length of five miles needed to service the current system. The transportation system linking the affected areas would not change. There would be no increased maintenance costs to the counties or the Forest Service. There would be no need to relocate the 6.9 miles of road around Rob Roy and Hog Park Reservoirs, as well as, Lakeview and Rob Roy Campgrounds. Current road and trail use patterns would not change and few increased demands would be put on the system.

# c. State and County Plans

This alternative would not seriously affect the state and county plans except in those areas of water management by limiting development options.

# d. Public Issues

This option would favorably address all public issues except the provision for recommended instream flows in Stage I streams. The remainder of the issues originated because of potential adverse effects from other than a no action alternative.

# 2. Alternative B - APPROVE PROJECT WITH MITIGATION

# a. Economic Feasibility

Alternative B would increase the amount of water to Cheyenne to 27,500 acre-feet. With all costs based on 1978 dollars the cost to the consumer would be \$1.50 per 1,000 gallons or \$489 per acre-foot.

The City cost would be \$ .66 per 1,000 gallons or \$216.00 per acre-foot. The cost to construct the system is estimated at \$75,924,000.

It would cost about \$126,500 annually to maintain diversion structures, access roads, and pipelines; operate flow releases; and treat water.

Annual energy consumption for operation has been calculated at 14,700 kilowatt hours.

Forest Service administrative costs during construction would be about \$25,000. This would be for a project liaison officer and for a crew to mark timber for removal from the right-of-way and feathered clearing edges. Administration of operating permits would consist of inspecting roads, pipelines, and collection structures twice a year. This would cost \$800. Detailed inspections of the dam site would be done by the Army Corps of Engineers every five years. Annual inspections would be conducted by the permittee, or his representative, and the Forest Service.

# b. Resource Management Concerns

With the instream flows provided for, the altered riparian habitat results from increasing the size of Rob Roy and Hog Park Reservoirs. A total of 1,007 acres is anticipated to be altered through reservoir inundation, 453 of which is riparian.

There would be an increase in water turbidity during construction due to the large area affected. After approximately five years, turbidity would return to current conditions when vegetation is established on disturbed sites. Salinity would increase 1.73 milligrams per liter of water measured at the Imperial Dam in Arizona. Detailed analyses of this alternative's impact and a complete data base is available in Appendix VIII (Section 1, Cheyenne Stage II Watershed Data).

Providing maintenance flows in Stage I streams would replace 259 Colorado River cutthroat trout Habitat Units in the North Fork of the Little Snake River drainage and 559 brook and brown trout Habitat Units in Douglas Creek which were lost due to inadequate instream flows.

The natural flow regime in Stage II streams would be altered significantly by diversion. Maintenance flows for Stage II streams would reduce the major adverse impacts on fish habitat. With the recommended maintenance flows, impacts would still occur including the loss of 13 Colorado River cutthroat trout Habitat Units and 15 brook and cutthroat—rainbow hybrid trout Habitat Units in the Little Snake drainage. There would also be a loss of 121 brook and brown trout Habitat Units due to the inundation of

5.8 miles of trout stream above Hog Park Reservoir. There would be a loss of 280 brook and brown trout Habitat Units from the inundation of 3.9 miles of trout stream above Rob Roy Reservoir. A loss of 18 brook and brown trout Habitat Units would occur in Stage II streams in the Douglas Creek drainage.

Additional adverse impacts associated with construction and access which were not quantified in trout Habitat Units would occur with diversion of seven Colorado River cutthroat trout streams and two brook trout streams in the Little Snake drainage and four brook and brown trout streams in the Douglas Creek drainage.

Hog Park Reservoir and Rob Roy Reservoir would be increased by 520 and 487 acres respectively. This would require additional stocking by the Wyoming Game and Fish Department. Augmenting flows in the South Branch of Middle Crow Creek would provide an estimated gain of 387 brook trout Habitat Units as mitigation. Fishery impacts are discussed further in Appendix VIII, Section 2, "Fisheries Data".

Two alterations to the dispersed recreation opportunities would be construction of additional roads and the enlargement of Rob Roy and Hog Park Reservoirs.

Additional access in the Little Snake River sector would alter opportunities from a semi-primitive motorized and nonmotorized type to a rural or roaded natural experience. This is because of an increased use of modern highway type motor vehicles. This area currently has 8,400 acres available to off highway types of motorized and nonmotorized recreation. The area would become accessible by highway vehicles. (Appendix V, Recreation Data.)

Lakeview and Rob Roy campgrounds would have to be relocated and would be at the expense of the proponent. There would not be an adverse effect on capacities because they would be replaced by the same size facilities. The only change would be use patterns. Enlarged reservoirs could attract water sport activities that are not present with existing Stage I facilities. This could cause an increase in recreation administrative costs.

The 5,210 acre Area IV, within the Huston Park Management Unit would be managed as nonwilderness under this option. Flow regimes would be established to protect the Encampment and Platte River recommended wilderness areas. There would be 62,112 acres, instead of the 67,322 available for possible inclusion as wilderness under the no action alternative.

This alternative would disturb the soils on about 2,580 acres of forest land. These disturbances are road construction, pipeline right-of-way clearing, and reservoir clearing associated with increased water levels. Borrow pits, spillway waste, and other waste disposal areas are located within the area to be inundated by the reservoirs. Mass land failure potential on 720 acres would be present primarily between West Branch and Roaring Fork. Within this corridor there are about 590 acres that are identified as having a very low revegetation potential. Total evaluation of all items and the soil survey is available in Appendix VIII, Section 3, Soils Data.

Hunting pressure could be expected to increase due to increased access. There could also be an anticipated increase in nonconsumptive use, as people would have easier access to view wildlife.

This alternative would result in a net terrestrial habitat loss of 1,007 acres, primarily around Hog Park and Rob Roy Reservoirs, where land is inundated through increased water levels.

The complete assessment is available in Appendix VIII, Section 4, Wildlife Data, and within the "Biological Assessment" found in the file of documents for public review at the Medicine Bow National Forest Office.

This alternative would affect ranchers in the Hog Park and Rob Roy areas who are permitted to graze livestock. It would also affect wildlife forage. The 1,007 acres lost by inundation would cause a reduction of 418 AUM's in grazing capacity for livestock and wildlife.

The effect on threatened and endangered species (Colorado squawfish and humpback chub) has tentatively been determined by the Forest Service as not significant. Consultation with the U.S. Fish and Wildlife Service has been requested. Formal consultation with the U.S. Fish and Wildlife Service will be continued to ensure effects on threatened and endangered species are properly addressed.

This alternative has the potential to produce adverse impacts on 493 acres of "outstanding" scenic resources (Appendix VIII, Section 5). The pipelines are designed to follow contours which reduce the nonmitigable vertical line impact.

There would be 532 acres of tree cover eliminated by roads, pipelines, and reservoir inundation. There would be 36.1 miles of new access which would open up unroaded land in the West Branch and Roaring Fork area and would provide for eventual development of an east-west link between Battle Highway and Hog Park. Actual impacts are documented in Appendix VIII, Section 6, Transportation.

A cultural survey will be required on 2,580 acres to determine the existence of items of cultural or historical significance. In addition, any artifacts uncovered during construction would require a work stoppage until investigations are complete.

#### c. State and County Plans

There has been no identified conflict between the conditions of this alternative and goals found in the State, Albany County, and Carbon County Land Use Plans.

# d. Resolve Public Issues

This alternative, with mitigation, will resolve public issues. Questions have been raised in respect to providing water for downstream users. Water permits have already been issued to Cheyenne for domestic water by the Wyoming State Engineer's Office. The other question is in respect to threatened or endangered species. Consultation with the Fish and Wildlife Service has been requested.

3. Alternative C - MODIFY STAGE I COLLECTION SYSTEM TO INCREASE CAPACITY AND EXTEND THE PROPOSED SYSTEM TO THE VICINITY OF WEST BRANCH OF THE NORTH FORK - LITTLE SNAKE RIVER.

# a. Economic Feasibility

This alternative would provide Cheyenne with approximately 21,500 acre-feet of water while all instream flows are maintained. Based on 1978 costs the consumers would pay about \$1.40 per 1,000 gallons or \$456 per acre-foot. Cheyenne's cost would be \$.58 per 1,000 gallons or \$198 per acre-foot. The estimated cost to construct this option would be \$63,000,000. Maintenance would cost approximately \$113,900 annually to operate the facilities, maintain access roads, maintain pipelines, and process water. This alternative would utilize approximately 14,700 kilowatt hours of electricity.

The Forest Service administrative costs during construction would be about \$23,000. These costs would be for a project liaison officer and for a crew to mark timber for removal from the right-of-way and along the feathered clearing edge. Inspections of roads, pipelines, and collection structures would be done twice a year and cost \$800 annually. Detailed inspection of the dams is required every five years and would be done by the Army Corps of Engineers. Annual inspections would be done by the permittee, or his representative, and the Forest Service.

#### b. Resource Management Concerns

The impacts on the riparian stream habitat would involve 453 of the 1,007 acres inundated around Hog Park and Rob Roy Reservoirs. The turbidity would increase during construction but would not affect watersheds past the West Branch.

Turbidity would not exceed state standards except under extreme climatic conditions. After five years when vegetation on disturbed areas would become established, turbidity would return to current levels. Salinity would increase 1.73 milligrams/liter at Imperial Dam (Section 1, Appendix VIII).

Providing maintenance flows in Stage I streams would replace 259 Colorado River cutthroat trout Habitat Units in the North Fork of the Little Snake River drainage and 559 brook and brown trout Habitat Units in Douglas Creek which were lost due to inadequate instream flows.

The pipeline in the Little Snake drainage would stop at Standard Creek. Water would not need to be collected in the Roaring Fork and Sherard Creek.

The natural flow regime in Stage II streams would be altered significantly by diversion. Maintenance flows for Stage II streams would reduce the major adverse impacts on fish habitat. With the recommended maintenance flows, impacts would still occur including the loss of 13 Colorado River cutthroat trout Habitat Units and 8 brook and cutthroat-rainbow hybrid trout Habitat Units in the Little Snake drainage. There would also be a loss of 121 brook and brown trout Habitat Units due to the inundation of 5.8 miles of trout stream above Hog Park Reservoir. There would be a loss of 280 brook and brown trout Habitat Units from the inundation of 3.9 miles of trout stream above Rob Roy Reservoir. A loss of 18 brook and brown trout Habitat Units would occur in Stage II streams in the Douglas Creek drainage.

Additional adverse impacts associated with construction and access which were not quantified in trout Habitat Units would occur with diversion of seven Colorado River cutthroat trout streams in the Little Snake drainage and four brook and brown trout streams in the Douglas Creek drainage.

Hog Park Reservoir and Rob Roy Reservoir would be increased by 520 and 487 acres respectively. This would require additional stocking by the Wyoming Game and Fish Department. Augmenting flows in the South Branch of Middle Crow Creek would provide an estimated gain of 387 brook trout Habitat Units as mitigation. Fishery impacts are discussed further in Appendix VIII, Section 2, "Fisheries Data".

The enlargement of Rob Roy and Hog Park Reservoirs plus increased access roads would be the alterations to the current recreation opportunity. There would be approximately 6,300 acres of semiprimitive motorized and nonmotorized dispersed recreation opportunities accessed by highway type vehicles (Appendix VII, Table 3).

About 3,800 acres of Area IV could be recommended for wilderness as described in the Huston Park Land Management Plan. This alternative would leave 65,892 acres in the Huston Park area recommended as wilderness.

Lakeview and Rob Roy campgrounds would have to be relocated at the expense of the proponent. The enlarged reservoir could provide an impact on the administration in terms of controls needed to keep use within limits of the carrying capacity.

The total disturbed area would be about 2,454 acres. Borrow pits, spillway waste, and other waste disposal areas are located within the areas to be inundated by the reservoirs. There would be 320 acres of land that would be very difficult to revegetate. Mass land failure potential amounts to 150 acres. The Soils data is in Appendix VIII, Section 3, Soils.

Hunting pressures would increase up to the West Branch area with new access to that point. The user days for consumptive use would be about 2,700 while the nonconsumptive use would be 300. This alternative would result in the loss of 1,007 acres of meadow and forest habitat, primarily around Rob Roy and Hog Park Reservoirs.

This alternative would affect ranchers in the Hog Park and Rob Roy areas. It would also affect wildlife forage. The 1,007 acres lost by inundation would cause a reduction of 414 AUM's in grazing capacity for livestock and wildlife.

The effect on threatened and endangered species (Colorado squawfish and humpback chub) has been determined by the Forest Service as not significant. Consultation with the U.S. Fish and Wildlife Service has been requested. Formal consultation with the U.S. Fish and Wildlife Service will be continued to ensure effects on threatened and endangered species are properly addressed.

This alternative would have the potential of producing an adverse impact on 493 acres of outstanding visual quality. Scenic value computations for this and other alternatives are found in Appendix VIII, Section 5, Landscape.

There would be 532 acres of tree cover eliminated by roads, pipelines, and reservoir inundation.

The transportation plan includes a new east-west route. Traffic use over the pipeline section could be limited since it would dead end. Use beyond the West Branch would remain as foot travel or horseback (Appendix VIII, Section 6, Transportation).

# c. State and County Plans

The State, Carbon County, and Albany County Land Use Plans were consulted. The increase in the amount of delivered water will meet only 78% of the water goals.

# d. Resolve Public Issues

This alternative, with mitigation, will resolve public issues. Access into unroaded areas will be limited to  $4\frac{1}{2}$  miles into unroaded areas. Issues of impact on downstream users have been considered and will also be resolved outside of the analysis described in this document since it is the responsibility of the Wyoming State Engineer to regulate permitted water uses.

# 4. Alternative D - CONSTRUCT A LOWER RESERVOIR IN THE NORTH OR MIDDLE FORK OF LITTLE SNAKE RIVER AND PUMP TO HOG PARK RESERVOIR

#### a. Economic Feasibility

This alternative would yield 27,500 acre-feet of water. The costs, based on 1978 dollars, to the consumer would be \$3.00 per 1,000 gallons or \$978 per acre-foot. Production costs to the City would be \$1.13 per 1,000 gallons or \$369 per acre-foot. Construction cost is estimated to be \$111,706,000. It would cost approximately \$2,355,260 annually to maintain these facilities. About \$2,280,000 would be expended for electrical power to operate a pumping system. Approximately 33,320,000 kilowatt hours of electricity annually would be required.

The Forest Service administrative costs during construction would be about \$15,000. These costs would be for a project liaison officer and for a crew to mark timber for removal from the right-of-way and along the feathered clearing edge. Administration of the operating permit would include inspections of roads, pipelines, and collection structures twice a year. This would cost \$600 annually.

Detailed inspections of dams are required every five years and would be done by the Army Corps of Engineers. Annual inspections would be done by the permittee or his representative and the Forest Service.

# b. Resource Management Concerns

There would be 514 acres of riparian stream habitat lost due to inundation of the lands involved with the low reservoir on the North or Middle Fork of the Little Snake River. This is included in the 1,907 acres that would be flooded by Hog Park, Rob Roy, and the Little Snake Reservoirs. Turbidity would increase during construction and would be concentrated in the Little Snake River rather than headwaters near the Continental Divide. The long term effect would return the turbidity to current conditions after the establishment of soil holding vegetation. Although there would be no diversion structures on the Little Snake drainages, the collection of the 30,000 acre-feet of water in the reservoir would cause the salinity increase to be 1.73 milligrams of solids per liter of water at Imperial Dam (Appendix VIII, Section 1, Watershed). The only diversions would be in the Douglas Creek area of the North Platte River system, with the tributaries of the Little Snake system under natural flow until they reached the lower reservoir.

Providing maintenance flows in Stage I streams would replace 259 Colorado River cutthroat trout Habitat Units in the North Fork of the Little Snake River drainage and 559 brook and brown trout Habitat Units in Douglas Creek which were lost due to inadequate instream flows.

This alternative has no gravity flow collection system in the Little Snake drainage. Fish populations, movements, and habitats in the upper Little Snake tributaries would not be affected. The natural flow regime in Stage II streams in the Douglas Creek drainage would be altered significantly by diversion. Maintenance flows for Stage II streams would reduce the major adverse impacts on fish habitat. With the recommended maintenance flows, impacts would still occur including the loss of 18 brook and brown trout Habitat Units in the Douglas Creek drainage. There would also be a loss of 121 brook and brown trout Habitat Units due to the inundation of 5.8 miles of trout stream above Hog Park Reservoir. There would be a loss of 280 brook and brown trout Habitat Units from the inundation of 3.9 miles of trout stream above Rob Roy Reservoir.

Populations of Colorado River cutthroat trout, which are located above the fish barrier installed by the Wyoming Game and Fish Department, may be affected by reservoir construction. Building a lower reservoir in the Little Snake drainage would result in a loss of 451 Colorado River cutthroat trout Habitat Units and 220 brook, brown, and rainbow trout Habitat Units due to the inundation of 4.9 miles of stream.

Additional adverse impacts associated with construction which were not quantified in trout Habitat Units would occur with diversion of four brook and brown trout streams in the Douglas Creek drainage.

Hog Park Reservoir and Rob Roy Reservoir would be increased by 520 and 487 acres respectively. This would require additional stocking by the Wyoming Game and Fish Department. The lower reservoir in the Little Snake drainage would provide 400 acres of reservoir which would also require stocking. Augmenting flows in the South Branch of Middle Crow Creek would provide an estimated gain of 387 brook trout Habitat Units as mitigation. Fishery impacts are discussed further in Appendix VIII, Section 2, "Fisheries Data".

Recreation opportunities remain semiprimitive, nonmotorized, and motorized with the exception of 2,700 acres converted to roaded natural or rural use resulting from improved road access between the Little Snake Reservoir and Hog Park (Table 3, Appendix VII).

Enlarging Hog Park and Rob Roy Reservoirs could change recreation activities. Developed recreation and travel increases would produce additional recreation administrative impacts. There would be an additional recreation impact on the lower reservoir. There is no current funding to provide facilities for this area. Opportunities would increase for the recreation visitor for water associated activities. The 5,210 acres in Area IV of Huston Park would be available for recommendation as wilderness. There would be a total of 67,322 acres available in the Huston Park area for wilderness recommendation.

This alternative would disturb soils on 3,079 acres with 500 acres of very low revegetation potential lands involved. Borrow and waste areas would be contained within the inundation area of Hog Park and Rob Roy Reservoirs. An off-site area for the Little Snake Reservoir would have to be established. There would be 740 acres susceptible to mass land failure, but improvements would be routed around these areas.

Hunting pressure and nonconsumptive wildlife use would be about 1,300 and 120 user days respectively. Current wildlife movement patterns and habitat areas, except for lands lost to reservoirs, would remain unchanged from the current situation (Appendix VIII, Section 4, Wildlife). Inundation by Hog Park, Rob Roy, and Lower Snake Reservoirs would result in a loss of 1,907 acres of terrestrial wildlife habitat.

This alternative would affect ranchers in the Hog Park, Rob Roy, and North or Middle Fork of the Little Snake River who are permitted to graze livestock. It would also affect wildlife forage. The 1,907 acres lost by inundation would cause a reduction of 455 AUM's in grazing capacity for livestock and wildlife.

The effect on threatened and endangered fish species (Colorado squawfish and humpback chub) has been determined by the Forest Service as not significant. Consultation with the U.S. Fish and Wildlife Service has been requested. Formal consultation with the U.S. Fish and Wildlife Service will be continued to ensure effects on threatened and endangered species are properly addressed.

The current visual quality would not be altered in the outstanding area between West Branch and Deadline Creek. The 443 acre outstanding area at Hog Park, would be altered somewhat by raising the water level. The outstanding qualities of the flat mirror reflecting plane of the water would still exist but the meadow-conifer contrast would not be present (Appendix VIII, Section 5, Landscape). There would be 532 acres of tree cover eliminated by roads, pipelines, and reservoir inundation.

Road and trail systems would be maintained as is with an anticipated 15.4 miles of new access needed to serve the pipeline system and reservoir areas. The recreation travel to Hog Park and Rob Roy would increase as they both would be larger (Appendix VIII, Section 6, Transportation). The transportation system would forego the opportunity to connect Battle Highway and Hog Park. Potential cultural resource disturbance would be 3,079 acres.

# c. State and County Plans

The Wyoming, Carbon County, and Albany County Land Use Plans were reviewed and no conflicts with the goals were identified.

# d. Resolve Public Issues

This alternative would meet several conditions in resolving public issues. It would eliminate the need for diversion structures in Stage II streams containing Colorado River cutthroat trout. The unroaded areas would remain in their current status. Effects on downstream users on the lower North Fork would remain in the current status. It would provide the proposed amount of water to Cheyenne.

# 5. <u>Alternative E</u> - PUMP FROM HOG PARK RESERVOIR TO ROB ROY RESERVOIR.

# a. Economic Feasibility

This alternative would increase the amount of water to Cheyenne to 27,500 acre-feet. Based on 1978 dollars, the cost to the consumer would be \$2.37 per 1,000 gallons or \$773 per acre-foot. Production costs to the City would be \$.91 per 1,000 gallons or \$298 per acre-foot. The estimated cost of construction would be \$81,132,000. Annual maintenance costs of this system would be \$2,409,310 with approximately \$2,280,000 being expended for electrical power to operate the pump system. There would be 33,350,150 kilowatts of electrical power needed annually.

The Forest Service administrative costs during construction would be about \$28,000. These costs would be for a project liaison officer and for a crew to mark timber for removal from the right-of-way and the feathered clearing edge. Administration of the operating permit would include inspections of roads, pipelines, and collection structures and would be done twice a year. This would cost \$900 annually. Detailed inspections of dams are required every five years and would be done by the Army Corps of Engineers. Annual inspections would be done by the permittee, or his representative, and the Forest Service.

#### b. Resource Management Concerns

The impacts on the riparian stream habitat would involve 246 of the 520 acres inundated around Hog Park Reservoir.

All borrow pits and waste areas would be contained within the area inundated by Hog Park Reservoir. Turbidity from construction would occur on all streams in the Little Snake drainage (between the end of the Stage I System and the Roaring Fork). This would return to current conditions in approximately five years where vegetation becomes established. Soil loss would be kept within State standards at all times except under extreme climatic conditions. Salinity would increase 1.73 milligrams per liter at Imperial Dam (Appendix VIII, Section 1, Watershed). Impacts on recreation opportunities would result from 8,400 acres being converted from

semiprimitive to roaded natural or rural use (See Table 3, Appendix VIII). Hog Park Reservoir would be increased in size. This would result in relocation of Lakeview campground and associated management impacts with water oriented recreation. The amount of land available with wilderness potential would be 62,112 acres with the 5,210 acre area IV in Huston Park managed as nonwilderness.

There would be 135 acres of additional right-of-way cleared on National Forest lands. There would have to be additional pipeline constructed across lands in the Platte Valley near Riverside to Boat Creek on the North Platte River. Pipeline mileage would increase to 90. These new pipelines would disturb 1,940 acres of land. Land of low revegetation potential is 900 acres. Mass land movement potential would exist on 900 acres. (Appendix VIII, Section 3, Soils.)

Providing maintenance flows in Stage I streams would replace 259 Colorado River cutthroat trout Habitat Units in the North Fork of the Little Snake River drainage and 559 brook and brown trout Habitat Units in Douglas Creek which were lost due to inadequate instream flows. The impacts of this alternative would differ from previous alternatives. Rob Roy Reservoir would not be enlarged and water would not be collected in the Douglas Creek drainage. New diversion structures would not be required in that drainage.

The natural flow regime in Stage II streams in the Little Snake drainage would be altered significantly by diversion. Maintenance flows for Stage II streams would reduce the major adverse impacts on fish habitat. With the recommended maintenance flows, impacts would still occur including the loss of 13 Colorado River cutthroat trout Habitat Units and 15 brook and cutthroat—rainbow hybrid trout Habitat Units in the Little Snake drainage. There would also be a loss of 121 brook and brown trout Habitat Units due to the inundation of 5.8 miles of trout stream above Hog Park Reservoir.

Additional adverse impacts associated with construction and access which were not quantified in trout Habitat Units would occur with diversion of seven Colorado River cutthroat trout streams and two brook trout streams in the Little Snake drainage.

Hog Park Reservoir would be increased by 520 acres. This would require additional stocking by the Wyoming Game and Fish Department. Augmenting flows in the South Branch of Middle Crow Creek would provide an estimated gain of 387 brook trout Habitat Units as mitigation. Fishery impacts are discussed further in Appendix VIII, Section 2, "Fisheries Data".

The alteration to terrestrial habitat would be 520 acres involved in the enlargement of Hog Park Reservoir. Hunting pressure and nonconsumptive wildlife uses would be 2,700 and 300 user days respectively (Appendix VIII, Section 4, Wildlife).

This alternative would affect ranchers in the Hog Park area who are permitted to graze livestock. It would also affect wildlife forage. The 520 acres lost by inundation and the additional impact by road construction and pumping stations would cause a reduction of 155 AUM's in permitted numbers and would reduce available forage by 309 AUM's for livestock and wildlife.

The effect on threatened and endangered fish species (Colorado squawfish and humpback chub) has been determined as not significant. Consultation with the U.S. Fish and Wildlife Service has been requested. Formal consultation with the U.S. Fish and Wildlife Service will be continued to ensure effects on threatened and endangered species are properly addressed.

The effect on the visual quality would involve alteration of 493 acres of outstanding quality. The rest of the alteration of the increased pipeline corridor would occur in close proximity to existing roads. Ground work to produce a feathered edge and a blending of the pipeline would be required (Appendix VIII, Section 5, Landscape). There would be 250 acres of tree cover eliminated by roads, pipelines, and reservoir inundation.

The 22.7 miles of new access road would extend the opportunity to include the future east-west link between Battle Highway and Hog Park. This would fit the transportation plan for the area (Appendix VIII, Section 6, Transportation).

The potential area of disturbance to cultural resources is approximately 1,940 acres.

# c. State and County Plans

This alternative does not conflict with goals in the Wyoming, Carbon County, and Albany County Land Plans.

# d. Resolve Public Issues

This alternative, with all mitigation, will resolve public issues. Impacts on downstream users will be resolved action outside the analysis recorded in this statement.

# 6. Alternative F - PUMP FROM NORTH PLATTE RIVER AT BOAT CREEK TO ROB ROY RESERVOIR

# a. Economic Feasibility

If this alternative were selected, 27,500 acre-feet of water would be available to Cheyenne. Based on 1978 dollars, cost to consumers would be \$2.37 per 1,000 gallons or \$773 per acre-foot.

Production cost to the City would be \$ .88 per 1,000 gallons or \$287 per acre-foot. Construction cost is estimated to be \$73,487,000. Annual maintenance cost for this system would be \$2,569,830. Approximately \$2,444,000 would be needed to operate the two pumping stations.

Annual energy consumption for this option would be 35,879,850 kilowatt hours.

The Forest Service administrative costs during construction would be about \$25,000. These costs would be for a project liaison officer and for a crew to mark timber for removal from the right-of-way and along the feathered clearing edge. Administration of the operating permit would include inspections of roads, pipelines, and collection structures twice a year. This would cost \$600 annually. Detailed inspections of dams are required every five years and would be done by the Army Corps of Engineers. Annual inspections would be done by the permittee or his representative and the Forest Service.

#### b. Resource Management Concerns

A total of 520 acres is anticipated to be altered through reservoir inundation, 246 of which is riparian. Borrow and waste areas would be within the area inundated by Hog Park Reservoir. Turbidity would increase in the Little Snake drainage from Stage I to Roaring Fork during the construction phase. This would return to current conditions in about five years when vegetation becomes established.

Salinity increase would be 1.73 milligrams per liter at Imperial Dam (Appendix VIII, Section 1, Watershed).

Providing maintenance flows in Stage I streams would replace 259 Colorado River cutthroat trout Habitat Units in the North Fork of the Little Snake River drainage and 559 brook and brown trout Habitat Units in Douglas Creek which were lost due to inadequate instream flows.

The natural flow regime in Stage II streams would be altered significantly by diversion. Maintenance flows for Stage II streams would reduce the major adverse impacts on fish habitat. With the recommended maintenance flows, impacts would still occur including the loss of 13 Colorado River cutthroat trout Habitat Units and 15 brook and cutthroat-rainbow hybrid trout Habitat Units in the Little Snake drainage. There would also be a loss of 121 brook and brown trout Habitat Units due to the inundation of 5.8 miles of trout stream above Hog Park Reservoir. Flow depletion due to direct diversion out of the North Platte River would result in a loss of 12,143 brook, brown, and rainbow trout Habitat Units.

Additional adverse impacts associated with construction and access which were not quantified in trout Habitat Units would occur with diversion of seven Colorado River cutthroat trout streams and two brook trout streams in the Little Snake drainage.

Hog Park Reservoir would be increased by 520 acres. This would require additional stocking by the Wyoming Game and Fish Department. Augmenting flows in the South Branch of Middle Crow Creek would provide an estimated gain of 387 brook trout Habitat Units as mitigation. Fishery impacts are discussed further in Appendix VIII, Section 2, "Fisheries Data".

Dispersed recreation opportunities would change from semiprimitive classification to roaded natural or rural on 8,400 acres (Appendix VIII, Table 3). Lakeview Campground would be relocated and new recreation administrative impacts could occur with increased water oriented recreation. Opportunities for flat water recreation could increase due to an enlarged reservoir providing a larger variety of water related activities.

The collection system in Huston Park would leave 62,112 acres of potential wilderness available for future classification. The proposed pump stations bordering the south boundary of the Savage Run Wilderness, plus development in Area IV of Huston Park would produce adverse effects on the wilderness character.

Mass land movement potential would exist on 800 acres. There would be an estimated 512 acres of land area with a very low regeneration potential due to steep slopes and very little topsoil (Appendix VIII, Section 3, Soils).

Full development of the collection system would open up the access into the Roaring Fork, providing increased hunting pressure. There would be an estimated 520 acres of terrestrial wildlife habitat lost due to increasing the surface acres of Hog Park Reservoir.

This alternative would affect ranchers in the Hog Park area who are permitted to graze livestock. It would also affect wildlife forage. The 520 acres lost by inundation, would cause a reduction of 268 AUM's in grazing capacity for livestock and wildlife.

The effect on threatened and endangered fish species (Colorado squawfish and humpback chub) has been determined by the Forest Service as not significant. Consultation with the U.S. Fish and Wildlife Service has been requested. Formal consultation with the U.S. Fish and Wildlife Service will be continued to ensure effects on threatened and endangered species are properly addressed.

There would be 493 acres of outstanding visual quality altered (Appendix VIII, Section 5, Landscape).

There would be 250 acres of tree cover eliminated by roads, pipelines, and reservoir inundation.

The transportation system would require 22.7 miles of new access from the Stage I system to the Roaring Fork of the Little Snake River and on Lake Creek near Douglas Creek (Appendix VIII, Section 6, Transportation).

There would be an estimated 1,777 acres of disturbance, which would require cultural surveys to insure there would not be any damage to this resource.

#### c. State and County Plan

There were no indications, in the affected County or State Land Use Plans, that this alternative would be in conflict with their goals within the project area.

#### d. Resolve Public Issues

The points of expensive water and increased access into unroaded areas would not be totally met by this alternative. The other concerns would be mitigated by applying all measures for the Little Snake and Lake Creek collection sections.

# 7. Alternative G - PUMP FROM THE NORTH PLATTE RIVER NEAR NORTHGATE, COLORADO TO POLE MOUNTAIN

## a. Economic Feasibility

This alternative would increase the amount of water to Cheyenne to 27,500 acre-feet. Based on 1978 dollars, cost to the consumer would be \$1.92 per 1,000 gallons or \$626 per acre-foot. Production costs for the City would be \$ .77 per 1,000 gallons or \$250 per acre-foot.

Construction costs are estimated to be \$71,781,000.

Annual maintenance costs for this system would be \$1,664,880, with \$1,530,000 being expended for electrical power to operate pumping stations. About 22,424,850 kilowatts would be required.

The Forest Service Administrative Costs during construction would be about \$25,000. These costs would be for a project liaison officer and for a crew to mark timber for removal from the right-of-way and the feathered clearing edge. Administration of the operating permit would include inspections of roads, pipelines, and collection structures done twice a year. This would cost \$600 annually.

Detailed inspections of dams are required every five years and would be done by the Army Corps of Engineers. Annual inspections would be done by the permittee or his representative and the Forest Service.

# b. Resource Management Concerns

A total of 520 acres is anticipated to be altered through reservoir inundation, 246 of which is riparian. Borrow and waste areas would be within the acreage inundated by Hog Park Reservoir. Turbidity in streams would extend to the Roaring Fork and would increase during a construction phase. Turbidity would return to current conditions in approximately five years after vegetation has become established. Salinity would increase 1.73 milligrams per liter at Imperial Dam (Appendix VIII, Section 1, Watershed Data).

Providing maintenance flows in Stage I streams would replace 259 Colorado River cutthroat trout Habitat Units in the North Fork of the Little Snake River drainage and 559 brook and brown trout Habitat Units in Douglas Creek which were lost due to inadequate instream flows.

The natural flow regime in Stage II streams would be altered significantly by diversion. Maintenance flows for Stage II streams would reduce the major adverse impacts on fish habitat. With the recommended maintenance flows, impacts would still occur including the loss of 13 Colorado River cutthroat trout Habitat Units and 15 brook and cutthroat-rainbow hybrid trout Habitat Units in the Little Snake drainage. There would also be a loss of 121 brook and brown trout Habitat Units due to the inundation of 5.8 miles of trout stream above Hog Park Reservoir. Flow depletion due to direct diversion out of the North Platte River would result in a loss of 12,807 brook, brown, and rainbow trout Habitat Units.

Additional adverse impacts associated with construction and access which were not quantified in trout Habitat Units would occur with diversion of seven Colorado River cutthroat trout streams and two brook trout streams in the Little Snake drainage.

Hog Park Reservoir would be increased by 520 acres. This would will require additional stocking by the Wyoming Game and Fish Department. Augmenting flows in the South Branch of Middle Crow Creek would provide an estimated gain of 387 brook trout Habitat Units as mitigation. Fishery impacts are discussed further in Appendix VIII, Section 2, "Fisheries Data".

The alteration to the recreation potential would be by additional roads into the Roaring Fork area and by increasing the size of Hog Park Reservoir. There would be 8,400 acres of semiprimitive dispersed area converted to roaded natural or rural use accessible to highway type vehicles. There would be increased opportunity for water oriented activites at Hog Park Reservoir. Recreation administration needs would also increase.

This alternative would create an impact on the wilderness character of the Little Snake drainage and would result in managing the 5,210 acre Area IV as nonwilderness (Table 4, Appendix VIII). There would be 62,112 acres available for recommendation as wilderness.

The total surface disturbance would involve about 1,739 acres with 680 acres being classified as very difficult to revegetate. Mass land potential exists on 830 acres. (Appendix VIII, Section 3, Soils). There would be 520 acres of habitat altered, primarily around Hog Park Reservoir. The increased road access to Roaring Fork would result in 2,700 user days for hunting and 300 user days of nonconsumptive wildlife use (Appendix VIII, Section 4, Wildlife).

This alternative would affect ranchers in the Hog Park area who are permitted to graze livestock. It would also affect wildlife forage. The 520 acres lost by inundation would cause a reduction of 309 AUM's in grazing capacity for livestock and wildlife.

The effect on threatened and endangered fish species (Colorado squawfish and humpback chub) has been determined by the Forest Service as not significant. Consultation with the U.S. Fish and Wildlife Service has been requested. Formal consultation with the U.S. Fish and Wildlife Service will be continued to ensure effects on threatened and endangered species are properly addressed.

This alternative would not damage the visual quality due to pipeline location in the Highway 230 right-of-way. The potential exists for visual quality alteration in the Little Snake area by disturbing 493 acres of outstanding visual quality (Appendix VIII, Section 5, Landscape).

There would be 250 acres of tree cover eliminated by roads, pipelines, and reservoir inundation.

There would be 24.1 miles of road constructed to the Roaring Fork. The opportunity would exist to provide for a future east-west link between the Battle Highway and Hog Park (Appendix VIII, Section 6, Transportation).

This alternative would require a cultural survey on 1,739 acres prior to any construction activities.

## c. State and County Plans

The Wyoming Carbon County and Albany County Land Use Plans have been reviewed and no identified conflict with their goals were noted.

### d. Resolve Public Issues

This alternative will resolve all identified public issues except those concerning access into unroaded areas.

#### C. CUMULATIVE EFFECTS OF FUTURE DIVERSIONS

Questions have arisen regarding the possible cumulative effects of the proposed Stage III water diversion project. The Forest Service has determined that Stage III is not dependent on Stage II.

Since no Stage III formal proposal has been submitted, data has not been gathered for the drainages that could be involved.

The State of Wyoming has appropriated \$400,000 in the 1980 legislature to do a feasibility study for lower reservoirs in the Little Snake drainage and for Stage III (Appendix VIII Enrolled Act Number 43 p. 6-7). A discussion on Stage III may be included on a limited basis in the FEIS "Green and Yampa Wild and Scenic River Study" now in preparation by the National Park Service. Stage III is no longer a part of the Cheyenne system. It is in the process of being turned over to the State of Wyoming to develop for communities downstream on the North Platte River.

## D. EFFECTS NOT MITIGATED

There would be from 520-1907 acres of range and wildlife habitat inundated by raising the levels of Hog Park, Rob Roy, and/or Little Snake Reservoirs. The suggested mitigation for these losses in the 1980 Draft U.S. Fish and Wildlife Coordination Act report was to have additional lands purchased by the proponent. These would be managed by the U.S. Forest Service or Wyoming Game and Fish Department for Wildlife Values. The U.S. Forest Service does not concur with this recommendation as stated. The range and wildlife habitat losses would not be mitigated.

			3
			P
			4
			4
			7

## IX. EVALUATION OF ALTERNATIVES

CONTENTS														Ī	Page
Summary	•	•	•	•	•	•	•	•	•	•	•	•	٠	•	108
Evaluation of Alternatives		•				•									110

## IX. EVALUATION OF ALTERNATIVES

#### A. SUMMARY

	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E	ALTERNATIVE F	ALTERNATIVE G
1. Economic Feasibility a. Amount of Water Delivered to Cheyenne Approximately 80% Collector Efficiency							
b. Cost to the Consumer - Rate per 1000 gal. 1978 Dollars Rate per acre-foot					0		
c. Cost to City - Rate per 1000 gal. 1978 Dollars Rate per acre-foot				0	0	0_	•
d. Project Construction Cost 1978 Dollars				0	0		
e. Annual Maintenance Cost - 1978 Dollars Do Not Include Annual Special Use Fee.				0	0		
f. Forest Service Administrative Costs, Construction/Maintenance - 1978 Dollars					0		
g. Electrical Power Consumed - Kilowatt Hours					0	0_	
Resource Management Concerns     a. Watershed     1) Riparian Habitat Altered		•	0	•			•
2) Salinity							
b. Fisheries 1) Game Species Existing							0
2) Trout Streams Diverted	9	0	0	0			
3) Miles of Stream Inundated		0					
4) Trout Habitat Units Lost							
c. Recreation 1) Dispersed Recreation change Semi-Primative to Rural	0		0	0		0	
<ol> <li>Developed Recreation Sites</li> <li>Displaced and Relocated</li> </ol>			0	0	0		•
d. Wilderness Potential 1) Acres Available		0	0	0	0	•	
2) Rating - Character Loss							
e. Soils 1) Surface Disturbance		0			()	0	
2) Mass Land Failure		0					
<ol> <li>Acres of Very Low Revegetation Potential</li> </ol>							
f. Range - Grazing Capacity - AUM's Lost		•	0		•	0	
g. Terrestrial Wildlife 1) Game Species Existing		0	0		0	0	
2) Acres of Habitat Lost		0		0	0	0	0
3) Consumptive Use - User Days							
4) Nonconsumptive Use - User Days		0	0		0	9	0



	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D	ALTERNATIVE E	ALTERNATIVE F	ALTERNATIV G
h. Threatened or Endangered Fish Species Present Downstream				•		0	
i. Visual Resources - Acres of Outstanding Quality Altered	•	0	0	0	0	0	0
j. Tree Resource - Acres Loss	0	()			0	0	0
k. Transportation - Roads, New Construction Miles		9			9	9	9
<ol> <li>Cultural Resources - Acres Needing Survey</li> </ol>		•	0	0		•	
State - County Plans a. State Plans 1) Meets Goals Land Plan			0	0			
2) Meets Goals Water Plan	$\bigcirc$						0
b. County Plans 1) Meets Goals Land Plan	0	0	0	0			0
2) Meets Goals Water Plan	$\bigcirc$			9	0	0	0
3) Domestic Water Use	0	0	•	0	•	0	0
Resolve Public Issues a. Cheyenne Needs Water	$\bigcirc$		0	•	$\circ$	0	
<ul> <li>Alternative Water Sources</li> <li>Considered</li> </ul>			0	0			0
c. Provide for Adequate Instream Flows	0	0			0	0	•
d. Will Decrease Stream Flows Below Maintenance Level		0	0				
e. Minimize Reservoir Fluctuation	0	0	•	0	0	0	0
f. Increase Colorado River Salinity	<u> </u>	•	0	0	0	0	0
g. Provide New Access into Unroaded Areas		0					
h. Adversely Impact Sensitive Species Habitat	0	0		0	•		•
i. Provide an Adverse Effect on Downstream Users				0	•		0
j. Adversely Affect Threatened and Endangered Species							0

	Highly Beneficial to the Category
0	Slightly Beneficial to the Category
	Neither Beneficial nor Detrimental to the Category
	Slightly Detrimental to the Category
$\bigcirc$	Highly Detrimental to the Category



#### B. EVALUATION OF ALTERNATIVES

The following rationale was used to arrive at a common scale for rating the various evaluation criteria and the effects of each alternative. The two categories used to arrive at a final evaluation are "importance and significance".

IMPORTANCE - This is a scale that was assigned on the basis of how important that criterion is in resolving issues. The rating values are: high, moderately high, moderate, low, and none.

SIGNIFICANCE - This is a scale that accounts for how a particular alternate action will affect the current status of a resource or entity. All effects are evaluated as beneficial or detrimental changes from the "no action" alternative. The rating values used are: highly beneficial, moderately beneficial, slightly beneficial, highly detrimental, moderately detrimental, and slightly detrimental.

EVALUATION SYMBOL - This is an illustration of the combination of importance and significance. It is an overall representation of how much weight that particular criterion will have in the selection of an alternative. If a particular criterion is highly important and the effects are highly beneficial, this indicates that the particular alternative is the best choice to satisfy the criterion. If the criterion has a high importance and the effects have highly detrimental significance then the alternative is the poorest choice to satisfy that criterion. Criteria that are not of high importance and effects that are not highly beneficial or highly detrimental, have less weight in the evaluation. The rating symbols used to illustrate evaluations on the summary are:

Highly Beneficial Category -

Slightly Beneficial Category -

Neither Beneficial Nor is Detrimental to the Category -

Slightly Detrimental to the Category -

Highly Detrimental to the Category - (

#### 1. Economic Feasibility

a. Amount of Water Delivered to Cheyenne - High importance.

Water in Wyoming is very important. This was illustrated by the State Legislature in 1980 when a law was passed, authorizing State funds for development of the proposal addressed in this Environmental Impact Sstatement. The action alternatives would provide a significant increase in water to Cheyenne. Alternative C would not provide as much water as Cheyenne officials want. Alternative C is moderately beneficial. Alternatives B, D, E, F, and G are highly beneficial.

b. Cost to the Consumer - Moderate importance.

The cost of water delivery is determined by the facilities needed to transport the water and environmental protection measures. For this reason, cost is of moderate importance. There will be a significant increase in cost, especially with alternatives D, E, and F. Significance is moderately detrimental for alternatives B, C, and G, and highly detrimental for D, E, and F.

- c. Cost to the City Same as cost to the consumer.
- d. Project Construction Cost Moderate importance.

There is concern about cost of construction, but the cost is determined by materials and labor requirements. The project construction cost is considered highly detrimental for alternative D; moderately detrimental for B, E, F, and G; and slightly detrimental for C.

e. Maintenance Cost - Moderate importance.

There is concern about maintenance cost, which is determined by charges for labor and power. The maintenance cost is considered highly detrimental for alternatives D, E, and F; moderately detrimental for G; and slightly detrimental for B and C.

f. Forest Service Administrative Costs - Moderate importance.

The Forest Service is concerned about economic efficiency in administration of National Forest System lands. The costs of administering a permit are small so they are slightly detrimental.

## g. Electrical Power Consumed - High importance.

Energy conservation is a national priority. Energy consumption for alternatives B and C is small so the significance is slightly detrimental. Energy consumption for D, E, F, and G is high so the significance is highly detrimental.

#### 2. Resource Management Concerns

#### a. Watershed

## 1) Riparian Habitat Altered - High importance.

The importance factor was rated high due to the sensitivity of this habitat. The significance is slightly detrimental because of mitigation factors built into each alternative. Overall ratings were slightly detrimental for all but alternative E. This alternative is highly detrimental since it would involve the North Platte River.

## 2) Salinity - Moderate importance.

In the lower reaches of the Colorado River, salinity is the most limiting water quality parameter. The increases in salinity will not vary with action alternatives; therefore, the significance rating is slightly detrimental for all alternatives. There would be no change with the No Action alternative.

#### b. Fisheries

#### 1) Game Species Existing - Highly important.

This category is included to show that with the flow recommendations, no change in species existing would be expected. There is, however, an increased potential for the loss of one or more pure strain Colorado River cutthroat streams by introduction of other species. This is associated with greater access. This category shows a slightly detrimental effect on the category through development since there will be a change in natural conditions.

2) Trout Streams Diverted - Importance moderately high.

The impact of pipeline and road construction, diversion structure installment, and flow regime change were not included in computing trout habitat units lost. These impacts are quantified simply by the number of streams to be diverted which support trout. The significance is moderately detrimental. Overall the rating will vary from no change to highly detrimental.

3) <u>Miles of Stream Habitat Inundated</u> - Moderate importance.

This category quantifies the loss of stream habitat to flat water reservoir habitat in miles of stream inundated. The significance is moderately detrimental. Stream habitat supporting natural reproducing trout populations is lost to reservoir habitat which would require stocking. Overall the alternatives rate between slightly detrimental to no change, depending on the actual miles of stream lost.

4) Trout Habitat Units Lost - Highly important.

A trout habitat unit is defined as the amount of habitat quality required to produce an increase in trout standing crop of one pound per surface acre (Binns, 1976). This category is based on the Wyoming Game and Fish Department Fish Division evaluation of the effects of each alternative. The habitat units displayed under the Effects of Implementation are valid only if the three assumptions found in Appendix VIII, Section 2 are met. This evaluation covers only major areas of impact and not the numerous minor impacts such as bridges, pipeline crossings, increased sediment during and after construction, and other construction related impacts. A table showing the number of habitat units which would be lost in each alternative if maintenance flows were not implemented is included in Section 2 - Appendix VIII.

### c. Recreation

1) <u>Dispersed Recreation Opportunity - Moderate importance</u>

The categories under this heading were all rated moderate since development would produce many side benefits, such as dispersing recreation over a larger area with a good road system. The significance is slightly beneficial since it does open up additional areas for dispersal of recreation visitors. This is somewhat balanced by the loss of semiprimitive experience. Overall the dispersed recreation activities would benefit slightly.

2) Developed Sites Displaced - Moderate importance

Displaced sites, although they will be replaced, were rated slightly detrimental due to the increased inconvenience to the recreation user during site relocation.

#### d. Wilderness Potential - Low importance

- 1) On an acreage basis the change in potential wilderness areas did not vary to such a large degree to warrant a high importance rating. In all alternatives the significance is slightly detrimental because there was not more than a 10% reduction in total area suitable for wilderness recommendation. Overall, the rating is slightly detrimental except alternatives C & D which would allow all or a portion of the 5,210 acre Area IV to be available for wilderness recommendation.
- 2) Wilderness Character Lost Low importance

Losses of wilderness characteristics to the existing or potential wilderness area is related to the proximity of the proposed Stage II development activities and the possible effects on natural stream flows, fishery, environment, solitude, and trailhead access. In all alternatives this was rated as either insignificant to slightly detrimental (Appendix V - 4a).

#### e. Soils

#### 1) Total Surface Area Disturbed - Low importance

This criterion is designed to show how much land will be disturbed by each alternative. Since it does not consider soil types, slope, or other factors, it is for general overall comparisons. The significance is moderately detrimental since the exposed bare soil will cause an increase in soil erosion at least until vegetation is re-established. All alternatives rated slightly detrimental due to soil loss during construction.

### 2) Mass Land Failure - High importance

Mass land failure was given a high importance because of the impact on capital investments, personal safety, and the surrounding resource should it occur. The significance is rated highly detrimental since occurrence can be disastrous to the affected area.

# 3) Very Low Revegetation Potential - Moderate importance

This criterion is designed to illustrate the difficulty of revegetation for each alternative. It also is an indicator of revegetation costs and length of time for reestablishment of vegetation. It is highly detrimental since these areas now have a vegetative cover.

## f. Range - Moderately important

Range was rated moderately important since grazing capacities for both livestock and wildlife are affected. The significance is moderately detrimental because mitigating measures would tend to offset losses in other areas.

#### g. Terrestrial Wildlife

## 1) Game Species Existing - High

Importance is high for all alternatives because of the public's interest and concern in wildlife. There is no change brought about by any alternative, therefore significance is neither beneficial nor detrimental.

### 2) Habitat Lost - Moderately High

Depending on the alternative, habitat in springfall big game range category rated high. All other alternatives are of lesser importance due to the amount of habitat affected. Significance is neither beneficial nor detrimental since none of the habitat is of a significant quantity to affect the species utilizing it.

#### 3) Consumptive Use - Moderately high.

This rated moderately high due to the importance of the area for hunting big game. The significance is moderately beneficial because each alternative has the potential for dispersing pressure on the herds. Overall the ratings vary according to the amount of area to be opened up that is now not roaded.

### 4) Nonconsumptive Use - Moderately high.

This was rated moderately high due to the importance of the area for viewing game. The significance was slightly beneficial because it was not as important for this use as hunting. Each alternative will disperse use but not necessarily into areas where animals can be readily seen.

#### h. Threatened or Endangered Species - High

This category rates high throughout because to allow any degradation of habitat or a loss of a species is in violation of a Federal law. The significance is neither beneficial nor detrimental since there are no effects injurious to their existence in any alternative.

## i. Visual Resource - Moderately high

The primary impacts are the creation of horizontal lines and line forms on the landscape. This is not a major visual impact since horizontal siphons have been eliminated from the proposal. For this reason it was rated moderately high in importance. This rating was selected because some of the area is primitive and even the horizontal scars created by the proposal would totally change the visual base of the area.

The significance scale is highly detrimental since there would be a complete change along the corridor area. Also taken into consideration is the physical alteration of two areas of outstanding-visual quality. One is within a recreation area and the change can be highly significant. Overall the category rated highly detrimental due to alterations over a large area. Alternatives C and D do not impact the Little Snake area as heavily as other action alternatives.

## j. Tree Resource - Moderately high

The loss of the production areas through inundation is important. Locally the small amount, depending on the alternative selected, appears unimportant but every loss of tree production areas is becoming critical due to the annual loss nationally. There will be a significant benefit from the access being constructed because the tree resource will be accessible for application of management practices.

#### k. Transportation - Miles of new road - Moderately High

This was rated moderately high to emphasize the opportunity to increase management opportunities in areas of limited access. The significance is moderately beneficial because it will help achieve better administrative control on resource management.

## 1. <u>Cultural Resources</u> - Moderate importance

Even though cultural resource surveys are required by law, the importance was rated moderate because regardless of the alternative, surveys have to be done. Actual importance will depend on the inventoried cultural sites that could be affected by a specific alternative and whether or not it can be mitigated.

The slightly detrimental significance was based on number of acres disturbed. The smaller amount of acres disturbed, the less likelihood of disturbing cultural resources and therefore less negative the effect.

## 3. State and County Plans - Moderately High

This item rated moderately high because of the importance to coordinate with state and local governments.

The significance was judged on just how adverse the effect would be not just a numerical rating to separate alternatives. The highly detrimental value indicates a serious effect because water is an important issue to address. Any alternative that would eliminate additional water would have a significant impact. Alternatives were also rated on the basis of meeting goals in relation to cost. The more expensive, the lower the rating.

### 4. Resolve Public Issues - High

There were varied rationales depending on the relative importance of the issue. Adequate instream flows, decreased stream flows, reservoir fluctuation, adverse impact on Colorado River cutthroat trout and threatened or endangered species were all very important issues or laws and were therefore rated high. Alternate water sources, access and impacts downstream were not as great as the former items and would not be instrumental in tipping the scale, so importance rated moderate.

Colorado River salinity is of national concern but 1.73 mg/l is not that significant of an amount; therefore, the importance rating was moderately high and significance is low.

The significance ratings were from highly beneficial to highly detrimental, depending on how well each alternative was anticipated to resolve that issue. If the alternative had a high benefit or a great loss, the ratings of significance were assessed accordingly.



Α.	IDENII.	LICALION	Or	IUE	FUREST	SEKATOE	1 1/1	וכן זנ	(1( <u>1</u>	מע	1,11	יויני	ATT I	. т v	ינו	
CONT	ENTS														<u>P</u>	age
The	Forest	Service	Pre	fers	Alteri	native C	•		•		•	•	•	•	•	120
Rati	ionale	for Pref	eren	ce o	of Atle	cnative (	C.								•	120



#### X. IDENTIFICATION OF THE FOREST SERVICE PREFERRED ALTERNATIVE

## A. THE FOREST SERVICE PREFERS ALTERNATIVE C

This alternative calls for modification of Cheyenne's Stage I water collection system to increase capacity. It also extends the collection system to Standard Creek in the vicinity of the West Branch of the North Fork of the Little Snake River drainage. The alternative is described in Section VII, E, 3.

#### B. RATIONALE FOR PREFERENCE OF ALTERNATIVE C

- 1. The Forest Service considered a no action alternative and a reasonable number of action alternatives. Several alternatives were eliminated from detailed study.
  - a. Growth management was eliminated because energy development, political orientations, and regulations put this alternative primarily in control of the City government and citizens of Cheyenne.
  - b. Water recycling was eliminated because none of the information indicated that water recycling was technologically feasible.
  - c. Weather and streamflow modification is not technically feasible or cost effective.
  - d. Purchase of well water in Laramie and Albany Counties would not be economically feasible.
  - e. Water conservation and rationing would not meet demands.
  - f. The original Cheyenne Proposal was eliminated from detailed consideration because it would cause unacceptable environmental impacts and their proposal made no provision to mitigate the environmental impacts.

The "no action" and six action alternatives were considered in detail. Any of the six action alternatives could have been selected. Each includes substantial mitigation measures to protect environmental values, except the loss of terrestrial wildlife habitat resulting from increasing reservoir sizes.

2. The Forest Service selected the preferred alternative after determining the effects caused by each alternative. Four criteria were used to evaluate each alternative.

#### a. Economic Feasibility

Cheyenne will need 22,500 acre-feet of water by the year 2000. All of the action alternatives except C will yield more than 22,500 acre-feet. Alternatives C and B would be equal in energy consumption. Both are more energy efficient than alternatives D, E, F, and G. Alternative C is the best choice because it would, at 80% collector efficiency, give Cheyenne 21,500 acre-feet at the lowest cost to the consumer, the lowest cost to the City, the lowest construction cost, and the lowest maintenance cost.

## b. Resource Management Concerns

Alternative A would be the best choice for meeting resource management concerns.

Effects of implementation as shown in Section VIII, A, for alternatives B, C, D, E, F, and G are the same for salinity and endangered fish. These effects were not useful in selecting a preferred alternative.

Effects in several categories are mitigated as part of each alternative. These effects include: riparian habitat altered, trout streams diverted, streams inundated, trout habitat units lost, and developed recreation sites displaced and relocated. Effects in the remaining categories do not point to a preference for a single alternative.

Alternative C is the best choice among action alternatives because it has the lowest potential for mass land failure and least acreage of low revegetation potential. The reason for the difference between alternative C and alternatives B, E, F, and G is that with the latter, collection facilities would extend beyond the vicinity of the West Branch of the North Fork of the Little Snake River. This extension of the collection facilities would go through an area with unstable soils, steep slopes, loose rock slides, and rock outcrops. Alternative C would allow about 3,800 acres to be considered for wilderness.

Alternative C would require less road mileage than alternatives B, E, F, and G, resulting in less conflict between wildlife, domestic livestock, and recreation users. Alternative D has the least road mileage.

#### c. State and County Plans

Alternatives B, D, E, F, and G would be consistent with these plans. Alternative C will provide for about 78% of the water Cheyenne desires. Alternatives B, D, E, F, and G would be better choices than Alternative C in respect to meeting Cheyenne's desires for water.

#### d. Resolve Public Issues

There is no difference between Alternatives B, C, D, E, F, and G in resolution of public issues. The choice is between Alternative A and the others.

The Wyoming Legislature passed Enrolled Act No. 43, during the 1980 session. Governor Herschler signed the act on March 19, 1980. This State law authorizes the construction of Stage II of the Little Snake River Water Management Project. The law also authorizes a State grant and loan to finance a portion of the construction.

The Forest Service prefers an action alternative rather than the no action alternative in order to favorably respond to the needs of Wyoming people. These needs were expressed by Wyoming's elected officials when they passed Enrolled Act No. 43 (Appendix VIII).

3. In summary, Alternative C is the preferred alternative because it provides Cheyenne 21,500 acre-feet of water; it resolves public issues; it is the most economically feasible among the action alternatives; and it best meets resource management concerns among the action alternatives.

## XI. CONSULTATION WITH OTHERS

<u>CONTENTS</u> <u>Pa</u>	age
Public Scoping Sessions	24
Interagency Scoping Sessions	25
Public Meetings Conducted by Others	29
Distribution of Draft Statements	30
Federal Agencies	30
State Agencies	31
County and Local Agencies	31
Organizations	32
Elected Officials	34
Media	37
Others	37



#### XI. CONSULTATION WITH OTHERS

#### A. METHODS OF PUBLIC INVOLVEMENT

## 1. Public Scoping Sessions

When the decision was reached to file an Environmental Impact Statement on the Cheyenne Stage II Proposal, a Notice of Intent was published in the Federal Register on February 7, 1979. The public was notified of scoping sessions through the news media. These sessions were held as follows:

Scoping Session: Baggs, Wyoming, 1/27/79

Substantive Input: Citizens of the Little Snake River Valley were concerned with adequate water for their uses and recommended support for a low reservoir option. The comments from this session led to the development of alternatives D.

Scoping Session: Encampment, Wyoming, 2/5/79

Substantive Input: There was a suggestion to keep the pipeline routes designated as access so snow-mobiles could legally use them in the winter. This would relieve the pressure of snowmobile use in big game winter range. This was considered in the transportation plan for the area.

Scoping Session: Cheyenne, Wyoming, 3/14/79

Substantive Input: Will the Forest Service have an Environmental Impact Statement that pertains to issues and one that documents Cheyenne's need for water? This question was formulated into issue number one and addressed in this Environmental Impact Statement.

Scoping Session: Laramie, Wyoming, 3/21/79

Substantive Inputs: None at this session.

## 2. Interagency Scoping Sessions

Other Federal, State and local agencies were involved in the scoping process. The following is a list of the interagency scoping sessions:

Scoping Session: Laramie, Wyoming, 12/4/78

Substantive Input: Comments from the interdisciplinary team relating to data and information needed to assess the project proposal. These comments were formulated into an assessment packet and presented to the City of Cheyenne on 12/14/78.

Scoping Session: Laramie, Wyoming, 12/14/78

Substantive Input: Water yields for the Little Snake River drainage are inconsistent. These yields were checked and evaluated, with agreement being reached between the City of Cheyenne and the U.S. Forest Service.

Lake Creek should be excluded from the assessment. The U.S. Forest Service determined there was a significant impact on the design capacity and the Lake Creek collection area needs to be assessed in this Environmental Impact Statement.

What stream data is needed for each stream within the proposed project area? Agreement was reached on data needs to determine streamflows (maximum, minimum, flows and forecasted depletion). These are assessed in the Environmental Impact Statement for all streams.

Scoping Session: Laramie, Wyoming, 1/25/79

Substantive Input: The U.S. Fish and Wildlife Service and the Wyoming Game and Fish believe there is need for close contact throughout the assessment process. The U.S. Fish and Wildlife Service, Wyoming Game and Fish, and the U.S Forest Service have worked closely on all phases of the proposal assessment.

A study needs to be made on the effects of reservoir increases on wildlife habitat. These items were assessed as a portion of the wildlife input in this Environmental Impact Statement.

A decision needs to be made on which agency will study each portion of the needed wildlife assessment. The U.S. Forest Service surveyed hydrologic characteristics; the U.S. Fish and Wildlife Service studied reservoir regulation and endangered species; and the Wyoming Game and Fish worked on the flow recommendations. All were combined for this Environmental Impact Statement.

Scoping Session: Laramie, Wyoming, 3/13/79

Substantive Input: A payback or release system from Hog Park Reservoir needs to be established to minimize lake fluctuation during the recreation season and during low water flows to protect Hog Park Creek and the Encampment River. Systems have been proposed to the State Engineer and a condition put in all action alternatives that a daily payback or release system is not acceptable.

A workshop was held in the afternoon to settle questions that occurred in the morning session. Problems were worked out on design questions in relation to trout entering other streams through the system. These items were assessed in this Environmental Impact Statement.

Scoping Session: Laramie, Wyoming, 3/22/79

Substantive Input: There are several stream sites that need to be identified where surveys will have to be done to establish hydrographs. The streams were selected, as the result of this workshop and the hydrographs developed. The hydrographs were used in designing alternative mitigation measures, collection potential, and instream flows used in this Environmental Impact Statement.

Scoping Session: Laramie, Wyoming, 4/5/79

Substantive Input: A System of Habitat Evaluation Procedures was discussed by the U.S. Fish and Wildlife Service. This system was used in developing their Coordination Act Report - 1980 Draft referenced in this Environmental Impact Statement.

Critical habitat for the Colorado squawfish and humpback chub has not been identified and assessment of impact will be difficult. The U.S. Forest Service completed a Biological Assessment in 1979 and a

Supplement in 1980 evaluating the impact on these species. Consultation on these species, as required in the Coordination Act, has been requested.

Scoping Session: Laramie, Wyoming, 4/19/79

Substantive Input: Water quality parameters need to be decided upon. There were 11 parameters decided upon, tests made, and results included as a part of the watershed input into this Environmental Impact Statement.

What other alternatives need to be studied for instream flow data? At this time alternatives E, F, and G were developed which were substantially studied and evaluated in this Environmental Impact Statement.

The Bureau of Land Management became concerned about effects on their wilderness studies. Sessions in the field were scheduled with the Rawlins area office of the BLM and problems were resolved. Included were instream flow studies on the Encampment River.

Scoping Session: Laramie, Wyoming, 5/19/79

Substantive Input: The Stage III and Savery proposals need to be discussed or the Stage II Assessment will not be in compliance with C.E.Q. regulations. The U.S. Forest Service determined these projects were not cumulative under the regulations and they received only brief reference in this Environmental Impact Statement.

Scoping Session: Laramie, Wyoming, 5/24/79

Substantive Input: A chart of minimum instream flows and flushing flows was presented by the Wyoming Game and Fish. This chart was revised through subsequent meetings with the U.S. Forest Service, Wyoming Game and Fish, U.S. Fish and Wildlife Service, and Banner and Associates. The final chart used in this Environmental Impact Statement is a result of those workshops.

The accuracy of the R-2 cross sag tape procedure for determining stream channel capacities was questioned. Questions were resolved by the U.S. Forest Service hydrologists and their method was used to collect the channel data for their Environmental Impact Statement.

Scoping Session: Laramie, Wyoming, 6/14/79

Substantive Input: Have you considered the effects of the prepayment schedule? The prepayment schedule has been incorporated into all action alternatives and recommendations sent to the State Engineer.

Scoping Session: Encampment, Wyoming, (Field Tour) 7/25-26/79

Substantive Input: Considerable discussion during the inspection of the Roaring Fork of the Snake River section as to the viability of extending the pipeline that far. Further inspection and evaluation of the discussion led to the development of Alternative C as presented in this Environmental Impact Statement.

Scoping Session: Laramie, Wyoming, 8/15/79

Substantive Input: State Water Quality Standards require no more than a  $\pm$  2° variation instream temperatures in cold water fishery streams. This item has been incorporated into the U.S. Forest Service assessment sent to the State Engineer requesting an early payback system from Hog Park Reservoir.

Scoping Sessions: Laramie, Wyoming, 9/10/79

Substantive Input: There needs to be mitigation measures designed for the habitat losses in streams and in the areas inundated by the reservoirs. This statement prompted several workshops on the topic resulting in the recommendations in the U.S. Fish and Wildlife Coordination Act Report - 1980 Draft and mitigation measures in Section VII of this Environmental Impact Statement.

## 3. Public Meetings Conducted by Others

There were the following meetings sponsored by others with comments made or questions answered by the Forest Service USDA. Those meetings were:

- -North Platte Citizens Committee Cheyenne, Wyoming, 3/29/79
- -Interdepartmental Water Conference Cheyenne, Wyoming, 4/3/79
- -Laramie Community College Ecology Class Cheyenne, Wyoming, 4/9/79
- -Interdepartmental Water Conference Hearing Baggs, Wyoming, 5/23/79
- -Wyoming Water Development Association Rawlins, Wyoming, 7/16/79
- -Interdepartmental Water Conference Cheyenne, Wyoming, 8/13/79
- -Wyoming Water Development Association Rawlins, Wyoming, 8/22/79
- -North Platte Citizens Committee Rawlins, Wyoming, 9/2/79
- -Wyoming Association of Municipalities Laramie, Wyoming, 10/27/79
- -Wyoming Water Resource Research Institute Laramie, Wyoming, 10/29/79
- -Wyoming Water Development Commission Hearing Saratoga, Wyoming, 12/11/79
- -Wyoming Water Development Commission Hearing Baggs, Wyoming, 12/12/79
- -Wyoming Water Development Commission Hearing Cheyenne, Wyoming, 1/30/80
- -Wyoming Water Development Commission Hearing Rawlins, Wyoming, 1/31/80

#### B. DISTRIBUTION OF DRAFT STATEMENTS

#### 1. Federal Agencies

Office of the Secretary Environmental Quality Activities U.S. Department of Agriculture

Office of Architectural and Environmental Preservation Advisory Council on Historic Preservation

Army Corps of Engineers Omaha District Office

Department of Commerce Assistant Secretary for Environmental Affairs

Director, CES, USDA College of Agriculture University of Wyoming

State Conservationist Soil Conservation Service United States Department of Agriculture

Chairman of the Council on Environmental Quality Office of the Environment U.S. Department of Energy

#### National:

Director, Office of Federal Activities Environmental Protection Agency

#### Regional:

EIS Review Coordinator Environmental Protection Agency

Director, Environmental Project Review Department of the Interior

Advisor on Environmental Quality Federal Energy Regulatory Commission

Executive Secretary
Missouri River Basin Commission

Management Analysis and Services Branch Rural Electrification Administration Environmental Services Division Soil Conservation Service

Office of the Acting Director Water Resources Council

## 2. State Agencies

Colorado Division of Wildlife

Morgan Library Colorado State University

Wyoming Department of Agriculture

Wyoming Department of Economic Planning and Development

Wyoming State Engineers Office

Wyoming Department of Environmental Quality

Wyoming State Forester

Wyoming Game and Fish Department

Wyoming State Planning Coordinating Office (A95)

Wyoming Commissioner of Public Lands

Wyoming Recreation Commission

Coe Library University of Wyoming

## 3. County and Local Agencies

Albany County Commissioners

Albany County Extension Agent

Albany County Planning Office

Town of Baggs

Carbon County Commissioners

Carbon County Extension Agent

Carbon County Planning and Zoning Commission

Cheyenne Board of Public Utilities

City of Craig, Colorado

Town of Dixon

Town of Encampment

City of Laramie

Laramie County Commissioners

Laramie County Extension Agent

Laramie County Planning Department

Library - Cheyenne, Wyoming

Library - Craig, Colorado

Library - Encampment, Wyoming

Library - Laramie, Wyoming

Library - Saratoga, Wyoming

Library - Rawlins, Wyoming

Mayor's Office City of Cheyenne

City of Rawlins

Town of Saratoga

Town of Savery

City of Slater

## 4. Organizations

American Mining Congress

American Wilderness Alliance

Baggs Sportsman Club

Carbon County Conservation Club

Carbon County Farm Bureau

Cheyenne High Plains Audubon Society

Colorado Farm Bureau

Colorado Open Space Council

Continental Divide Water Coalition

Conservation Library - Denver Public Library

The Environmental Defense Fund

Federal Timber Purchasers Association

Hines Lumber Company

International Snowmobile Industry Association

Izaak Walton League of America-Colorado

Izaak Walton League Cheyenne Chapter

Izaak Walton League Travell Chapter

Izaak Walton League Wyoming Division

Laramie Chamber of Commerce

Laramie Wilderness Coalition

League of Women Voters

Murie Audubon Society

National Audubon Society Alpine Chapter

Natural Resource Clinic

North Platte Citizens Committee

Rawlins Snowmobile Club

Rawlins-Carbon County Chamber of Commerce

Saratoga Farm Bureau

Saratoga-Platte Valley Chamber of Commerce

Sierra Club Legal Defense Fund

Snowy Range Group, Sierra Club

Western Representative Wildlife Management Institute

Wyoming Association of Municipalities

Wyoming Farm Bureau

Wyoming Outdoor Council

Executive Director
Wyoming Stock Growers Association

Wyoming Wildlife Federation

Wyoming Wool Grower's Association

## 5. Elected Officials

Honorable Richard B. Cheney House of Representatives

Honorable Alan K. Simpson United States Senate

Honorable Malcolm Wallop United States Senate

Wendy Ockers Field Representative for Congressman Richard B. Cheney

Debbie Maxon Field Representative for Senator Alan K. Simpson

Byra Kite State Representative for Senator Malcolm Wallop

Honorable Shelia Arnold Wyoming State Representative Albany County

Honorable June Boyle Wyoming State Senator Albany County

Honorable Bob J. Burnett Wyoming State Representative Albany County Honorable Ellen Crowley Wyoming State Representative Laramie county

Honorable O. R. "Bud" Daily Wyoming State Senator Carbon County

Honorable William C. Edwards Wyoming State Representative Laramie County

Honorable Matilda Hansen Wyoming State Representative Albany County

Honorable Ed Herschler Governor of Wyoming

Honorable T. A. Larson Wyoming State Representative Albany County

Honorable C. M. Lummis Wyoming State Representative Laramie County

Honorable Patti MacMillan Wyoming State Representative Albany County

Honorable Rodger McDaniel Wyoming State Senator Laramie County

Honorable Bill McIlvain Wyoming State Representative Laramie County

Honorable B. G. "Jerry" Michie Wyoming State Representative Carbon County

Honorable Wm. M. "Bill" Murray Wyoming State Senator Laramie County

Honorable David R. Nichol Wyoming State Senator Albany County Honorable Milton E. Nichols Wyoming State Senator Laramie County

Honorable J. W. "Jim" Norris Wyoming State Senator Laramie County

Honorable Carrol P. Orrison Wyoming State Representative Laramie County

Honorable Elizabeth Phelan Wyoming State Representative Laramie County

Honorable Dean Prosser Jr. Wyoming State Representative Laramie County

Honorable W. G. "Bill" Rector Wyoming State Senator Laramie County

Honorable George R. Salisbury Jr. Wyoming State Representative Carbon County

Honorable Mary K. Schwope Wyoming State Representative Laramie County

Honorable Thomas E. Trowbridge Wyoming State Representative Carbon County

Honorable Pat Tugman Wyoming State Representative Laramie County

Honorable Walter C. Urbigkit Jr. Wyoming State Representative Laramie County

Honorable Alvin Wiederspahn Wyoming State Representative Laramie County

## 6. Media

Casper Star Tribune

Daily Times

Denver Post, Inc.

Douglas Budget

Glenrock Independent

KTWO TV and Radio News Bureau

**KYCU-TV Station** 

Laramie Daily Boomerang

News Record

Platte County Records-Times

Rocky Mountain News

Saratoga Sun

Torrington Telegram

United Press International

Wyoming Eagle

Wyoming Star Tribune

## 7. Others

A Bar A Ranch

George T. Baxter

Hans Blieker

Colleen Cabot

Keith W. Covington

Dwain W. Cruse

Robert Grieve

Noel V. Hayes

Bart Koehler

Elmer Johnston

Herrick K. Lidstone

W. J. Lucas

Joe B. Mattern

Pat McGuire

Roberta Moore

Dave Nordwall

Wayne Platt

Paul Rechard

Terry M. Reidy

Rocky Mountain Forest & Range Experiment Station - Fort Collins

Rocky Mountain Forest & Range Experiment Station - Laramie

Dwight R. Smith

Donald Warder

Mr. Thomas Wesche

Wilderness Institute School of Forestry University of Montana

Nelson E. Wren, Jr.

## XII. INDEX

CONTEN	TS	3															Page
Index				•		•				•				•			140



## XII. INDEX

A	Page
Acre-feet	15, 26, 32, 47, 48, 49, 52, 53, 58, 59, 60, 64, 65, 69, 70, 82, 84, 102, 121, 122
Alternatives	3, 16, 23, 36, 37, 40, 43, 44, 46, 50, 52, 54, 56, 58, 62, 64, 67, 69, 72, 74, 77, 884, 88, 91, 93, 95, 105, 110, 111, 112, 118, 120, 121, 122, 126, 127
В	
Big Game Species	28
Brook Trout	24, 39, 84, 85, 89, 92, 93, 97, 100, 103, 104
Brown Trout	24, 39, 84, 85, 89, 92, 93, 97, 100, 103
C	
Cheyenne Board of Public Utilities	1, 2, 11, 15, 20
Collection Facilities	40, 64, 121
Colorado River Cutthroat Trout	17, 18, 23, 39, 84, 85, 89, 92, 93, 95, 97, 100, 103, 112, 118
Colorado Squawfish	5, 18, 25, 86, 90, 95, 98, 101, 104
Costs	121
Consumptive Use	28, 33, 90, 94, 116
County Agencies	131
Cultural Resources	33, 117

## Page

Diversion	. 11, 24, 25, 37, 40, 44, 46, 50, 52, 56, 58, 60, 62, 64, 65, 67, 69, 70, 72, 77, 82, 92, 103
Douglas Creek	2, 11, 13, 16, 24, 25, 38, 46, 49, 52, 53, 54, 60, 61, 64, 65, 66, 69, 70, 72, 74, 84, 85, 89, 92, 93, 97, 100, 102, 103
Е	
Economic Feasibility	. 32, 88, 95, 99, 102, 111, 121
Effects	. 18, 19
Elected Officials	. 134
Electrical Power	32, 91, 96, 102, 112
Encampment River	. 11, 13, 16, 27, 37, 38, 39, 50, 69, 86, 126
Energy Consumption	. 99
Evaluation Criteria	. 32
F	
Federal Agencies	. 130
Flushing Flows	47, 52, 64, 70, 75
G	
Green River	19, 25
Growth Management	. 38
Н	
Habitat	. 32
Habitat Units	32, 84, 85, 92, 93, 97, 98, 100, 103, 104, 113
Hog Park Creek	45, 11, 16, 37, 39, 50, 126
Hog Park Drop	47, 53, 59, 64, 65, 67, 70, 75

## Page

7 9	, 3, 4, 6, 11, 17, 18, 24, 26, 29, 37 9, 41, 46, 53, 58, 59, 64, 65, 67, 70, 2, 75, 77, 83, 85, 86, 88, 89, 90, 92, 3, 94, 95, 96, 97, 98, 100, 101, 103, 04, 106, 126, 128
Humpback Chub 5	, 18, 25, 86, 90, 95, 98, 101, 104
Huston Park	, 27, 29, 36, 82, 86, 90, 94, 97, 101
I	
Importance 1	11, 112, 113, 114, 115, 116, 117, 118
Instream Flows 2	4, 34, 39, 84, 118
Interbasin Transfer 6	
Issues 1	5, 16, 17, 18, 34, 98, 122
L	
Lake Creek 1	3, 16, 17, 49, 61, 102, 125
Lake Owen	1, 13, 22, 48, 49, 54, 55, 60, 61, 64, 67, 69, 70, 71, 72, 77
5	, 6, 11, 13, 16, 17, 19, 23, 46, 52, 56, 8, 59, 67, 69, 72, 74, 88, 89, 91, 92 00, 102, 120, 121, 122, 124, 125
М	
Maintenance8	8
Maintenance Flow 5	2, 64, 70, 75, 84, 93, 97, 100, 103
Media	37
Medicine Bow Mountains 2	, 11, 22
	, 4, 11, 13, 22, 26, 37, 50, 74, 76, 77, 5, 89, 93, 98, 100, 104

## Page

Mitigation	4, 37, 89, 91, 93, 98, 100, 104, 126
Monitoring	38
N	
Nonconsumptive Use	28, 33, 90, 94, 98, 104, 116
North Platte River	2, 3, 11, 13, 16, 64, 65, 66, 69, 70, 71, 72, 74, 76, 77, 86, 92, 97, 99, 100, 103, 105
0	
Organizations	132
Р	
Permits Needed	20
Pole Mountain	3, 4, 11, 13, 17, 22, 30, 37, 46, 49, 52, 55, 61, 66, 71, 74, 76, 77
Preferred Alternative	5, 120
Public Meetings	129
R	
Rainbow Trout	84, 100
Range	28, 33
Recreation	25, 26, 33, 82, 85, 90, 94, 96, 101, 104, 114, 121
Riparian Habitat	32, 37, 88, 92, 96, 103, 112
Rob Roy Reservoir	1, 3, 5, 6, 11, 17, 18, 25, 26, 39, 41, 48, 53, 60, 64, 65, 67, 69, 71, 72, 83, 85, 86, 88, 89, 90, 92, 93, 94, 95, 97, 99, 106

Yampa River. .

Salinity	6, 17, 23, 32, 34, 84, 88, 92, 96, 100, 103, 112
Scoping Sessions	15, 36, 124, 125, 126, 127, 128
Sierra Madre Mountains	1, 2, 11, 22, 30
Significance	110, 112, 113, 114, 115, 116, 117, 118
Soils	19, 27, 94, 115
Special Use Permit	20
Stage III	105, 127
State Agencies	131
Stream Flows	6, 16
Streams Diverted	7, 32, 80, 108
Т	
Threatened and Endangered Species	18, 19, 25, 33, 34, 36, 90, 95, 98, 101 104, 116
Transportation	30, 33, 91, 102, 117, 124
Tree Resource	33, 117
V	
Visual Resource	19, 29, 33, 117
W	
Water Conservation	39
Water Recycling	38, 120
Weather Modification	4, 38, 120
Wilderness	27, 33, 37, 94, 114, 127
Y	

19, 25

## XIII. APPENDIX

CONTENTS																									Pages
Appendix	Ι			•	•			•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	I-1 - I-8
Appendix	V						•	•							•	•		•	•		•	•	•	•	V-1 - V-9
Appendix	VI	Ι		•		•		•			•	•	•	•	•		•	•		•	•	•	•	•	VII-1 - VII-4
Appendix	VI	ΙΙ	[.												•							•			VIII-1 - VIII-60

	,	

## APPENDIX I

Contents	Page
Interdisciplinary Team	I-2
Team Involvement Creditation	1-3
List of Documents in File available for Public Review	I-6
Bibliography	I-8



# MEDICINE BOW NATIONAL FOREST INTERDISCIPLINARY TEAM CHEYENNE STAGE II WATER DIVERSION PROPOSAL

#### Member

Don M. Bolinger
William Blunt
John Nordin
Ron Bauer
Chris Marvel
Clair Finley
Peter Stewart
Raymond Urbom
Chuck Sperry
Tim Chesley
Dennis Jespersen
Donald Schmidtlein

## Specialty

Project Coordinator
Wildlife Management
Soils Management
Soils Management
Landscape Architecture
Timber Management
Hydrology
Recreation
Engineering
Engineering
Fisheries
Range

## IN SERVICE SPECIALIST INPUT

Richard Moore Greg Bevinger Larry Thoney Terry Hoffman Kent Van Joe Remick Regional Fisheries Biologist Hayden Ranger District Hayden Ranger District Laramie Ranger District Laramie Ranger District Hayden Ranger District

Fisheries
Hydrology
District Ranger
District Ranger
Range
Range

#### OTHER INPUT

Larry Lockard Mike Irwin Mike Stone Don Miller Fred Stabler Robert Roumph Tim Connor U.S. Fish & Wildlife Service
U.S. Fish & Wildlife Service
Wyoming Game & Fish
Wyoming Game & Fish
Bureau of Land Management
Army Corp of Engineers
Banner and Associates

Fisheries Wildlife Fisheries Fisheries Hydrology Engineering Engineering

#### TEAM INVOLVEMENT

The following Forest Service personnel contributed to the preparation of the Environmental Impact Statement:

#### A. MANAGEMENT TEAM

- 1. Donald L. Rollens Forest Supervisor, Medicine Bow National Forest, B.S. Forest Management, University of Missouri. Twenty-one year's experience with Forest Service U.S.D.A. Majority of experience is in line positions, including District Ranger, Deputy Forest Supervisor and Forest Supervisor. Experience on seven National Forests, Regional Office and two Forest Service Regions.
- 2. Ladd G. Frary Resource Staff Officer, Medicine Bow National Forest. B.S. and M.S. Wildlife Management, Colorado State University. Eighteen year's experience with Forest Service U.S.D.A. Nine years as District Ranger and eight years in Range and Wildlife Staff positions. Prior to employment with F.S. had spent eight years in Wildlife Research and Management with Colorado, South Dakota and New Mexico Game & Fish Departments.
- 3. John T. Quinn Resource Staff Officer, Medicine Bow National Forest. B.S. Range Management Mississippi State University. M.F. Forestry, Utah State University. Post Graduate, Political Science, Syracuse University. Twenty-two year's Forest Service experience. Seven years District Ranger, six years Timber and Fire Staff, two years Land Planning, three years Supervisory Forester Staff.
- 4. John Gillum Forest Engineering Staff Officer. B.S. Civil Engineering, University of Kansas. Reg. Prof. Engr. in States of Wyoming and South Dakota. EIT in Kansas. Nineteen year's experience in Civil Engineering with Forest Service U.S.D.A. on three Forests plus Regional Office. Experience with Kansas State Highway Department approximately one year (Prior to Forest Service experience).
- 5. Ron Olsen Land Planning Staff Officer, Medicine Bow National Forest. B.S. Forestry, University of Minnesota. Eighteen and one-half year's experience with Forest Service U.S.D.A. Two years Timber Forester, six years Watershed Specialist, ten years Planning Staff Officer.
- 6. Larry Thoney District Ranger, Hayden District. B.S. Forest Management, Michigan State University. Thirteen year's experience Forest Service U.S.D.A. Two years District Ranger, two and one-half years Timber Project Staff, three years Timber Special Uses District, two years Assistant Ranger, three years Timber.

7. Terry Hoffman - District Ranger - Laramie District. B.S. Forestry, University of Michigan. Fourteen year's experience Forest Service U.S.D.A. Seven years Resource Forester, seven years District Ranger.

## B. INTERDISCIPLINARY TEAM

- Don M. Bolinger Special Projects Coordinator Medicine Bow National Forest. Seventeen year's experience Forest Service U.S.D.A. B.S. Forest Management, Iowa State University. Six years Assistant Ranger - Timber, Recreation and Land Uses. Seven years Range and Fire Management. Four years Special Projects and Environmental Coordinator.
- 2. William H. Blunt Wildlife Biologist, Medicine Bow National Forest. B.S. degree in Wildlife Management, Colorado State University. Twenty years with Forest Service U.S.D.A. working in all resource fields with special emphasis in Wildlife, Range, and Timber management. Experience on five National Forests, six Ranger Districts and three Supervisor's Offices in R-2.
- 3. Donald W. Schmidtlein Range Staff Medicine Bow National Forest. B.S. degree Range Management, Utah State University. Twenty-four years Forest Service U.S.D.A., Prior twenty year's experience ranching Nevada and Idaho. District Ranger for five years, R-4, seven years. R-2, experience on four National Forests as Range Con., Assistant Ranger, Ranger, and Range Staff.
- 4. Chris Marvel Forest Landscape Architect, Medicine Bow National Forest, Bachelor of Landscape Architecture, Suny College of Environmental Science and Forestry at Syracuse University, two year's experience Forest Service U.S.D.A., eight years New York State DOT, Registered Landscape Architect New York State, #676, two years Small Private Practice.
- 5. Ray Urbom Recreation and Lands Staff Officer, Medicine Bow National Forest. B.S. in Forest Management, Utah State University 1949. Thirty year's experience with Forest Service U.S.D.A. working in Idaho, Colorado, and Wyoming. District Ranger for thirteen years on three different Ranger Districts in Colorado. Recreation & Lands Staff on Medicine Bow since 1968.
- 6. Ronald Bauer Soil and Water Project Staff, Medicine Bow National Forest. B.S. General Agriculture Colorado State University. Nineteen year's experience with Forest Service U.S.D.A. in Regional Office, R-2 and San Juan National Forest. Soil Survey, Soil Survey Party Chief and special projects.

- 7. Pete Stewart B.S. Watershed Management, University of Arizona. Ten years total experience with Forest Service U.S.D.A. One year Job Corps YCC. Four years Fire Management, five years Watershed Management.
- 8. John Nordin Soil Management Specialist, Medicine Bow National Forest. M.S. and B.S. in Soil Science from University of Minnesota. Six year's experience with Forest Service U.S.D.A. Soil Conservation Service and one year experience with Forest Service.
- 9. Charles T. Chesley Civil Engineer, Medicine Bow National Forest. Five year's experience Forest Service U.S.D.A. B.S. Civil Engineering University of New Hampshire. Five years civil engineering White Mountains National Forest, Superior National Forest, Medicine Bow National Forest.
- 10. Dennis Jespersen Fisheries Biologist Medicine Bow National Forest. - B.S. Biology M.S. Fisheries Management, University of Wyoming. Two years Fisheries Forest Service U.S.D.A. Six months Wyoming Game and Fish.
- 11. Clair Finley Forester (Silviculture), Medicine Bow National Forest. - B.S. Outdoor Recreation, Colorado State University, eleven years Forest Service U.S.D.A. eight years Districts, White River and Medicine Bow National Forests. Two years in present position.

## LIST OF DOCUMENTS IN FILE AVAILABLE FOR PUBLIC REVIEW

#### TITLE OF DOCUMENT

- 1. Correspondence General
- 2. City Project Proposal
- 3. Notice of Intent
- 4. Meeting Notes Forest Service Sponsored
- 5. Meeting Notes Public Scoping Sessions
- 6. Meeting Notes Forest Service attended Sponsored by others
- 7. EIS Outline, Criteria and Issue Development
- 8. State of Wyoming Legislation Involving Proposal
- 9. Federal Laws Regulations for Project NEPA, etc.
- 10. News Releases Pertaining to Project
- 11. Appeals Huston Park Land Management Plan
- 12. Assessment Packet
- 13. Huston Park EIS & Management Plan
- 14. WRRI Cost Analysis
- 15. Flow Determination for Fisheries D. Jespersen 1979 & 1980
- 16. City of Cheyenne Water Permit
- 17. 1974 Banner Report
- 18. 1976 Banner Report
- 19. 1979 Banner Report
- 20. 1979 Forest Service Biological Assess.
- 21. SCS Soils Report Northgate
- 22. Salinity Report Stewart 7/79
- 23. Augmented Flow Assessment Stewart 11/79
- 24. Analysis of Cheyenne Stage II Prepared for IDWC by Wyoming Water Program Redbook 12/78

- 25. Original Cheyenne Water Supply Plan 3/61 Banner & Associates
- 26. Cheyenne Feasibility Study WRRI 11/79
- 27. Draft Wild & Scenic River Study Yampa & Green Rivers NPS 6/79
- 28. Environmental Statement Input Watershed
- 29. E.I.S. Cheyenne Stage II Study Data Fisheries
- 30. E.I.S. Cheyenne Stage II Study Data Soils
- 31. E.I.S. Cheyenne Stage II Study Data Wildlife
- 32. E.I.S. Cheyenne Stage II Study Data Landscape
- 33. E.I.S. Cheyenne Stage II Study Data Transportation
- 34. E.I.S. Cheyenne Stage II Study Data Recreation
- 35. Appendix Biological Assessment of 1979
- 36. E.I.S. Cheyenne Stage II Study Data Timber
- 37. Fish and Wildlife Service Coordination Report
- 38. Draft & Final E.I.S. RARE II Draft E.I.S. Wyoming RARE II
- 39. Water Quality Standards Wyoming Department of Environmental Quality
- 40. Bureau of Land Management Involved Lands Pipeline

#### BIBLIOGRAPHY

- Banner Associates, Inc. 1976 Report on Proposed Expansion of
  Cheyenne's Little Snake Diversion Facilities. Prepared for the
  City of Cheyenne, Wyoming, Board of Public Utilities.
- Banner & Associates, Inc., 1977. Report on Proposed Expansion of Cheyenne's Douglas Creek Facilities. Prepared for the City of Cheyenne, Wyoming, Board of Public Utilities.
- Banner Associates, Inc. June 1979. Supplemental Information on the Cheyenne Stage II Water Supply Expansion for the Draft
  Environmental Impact Statement. Prepared for the City of Cheyenne, Wyoming, Board of Public Utilities.
- Binns, N.A. and F.M. Eiserman, 1979. Quantification of Fluvial Trout Habitat in Wyoming. Trans. Amer. Fish. Soc. 108:215-228.
- U.S. Fish and Wildlife Service Coordination Report <u>Cheyenne</u> Water Supply Project. U.S. Fish and Wildlife Service Region 6.
- Jespersen, D.M. Instream Flow Determination and Impact Evaluation of Water Diversion on the Colorado River Cutthroat Trout and Brook Trout in the North Fork and Roaring Fork of the Little Snake River Drainage, USDA Forest Service, June 1979.
- Wesche, T.A., 1973. Parametric Determination of Minimum Streamflow for Trout Water Resources Series No. 37. Wyoming Water Resources Research Institute, Laramie, Wyoming, 102 pp.
- Wesche T.A., 1974. Relationship of Discharge Reductions of Available
  Trout Habitat for Recommending Suitable Streamflows. Water
  Resources Series No. 52. Wyoming Water Resources Research Institute,
  Laramie, Wyoming 73 pp.
- Wesche, T.A., 1977. Fishery Resources and Instream Flow Recommendations for Streams to be Impacted by Cheyenne's Proposed Phase II Development.

  Report submitted to Wyoming Game and Fish Dept. 150 pp.



## APPENDIX V

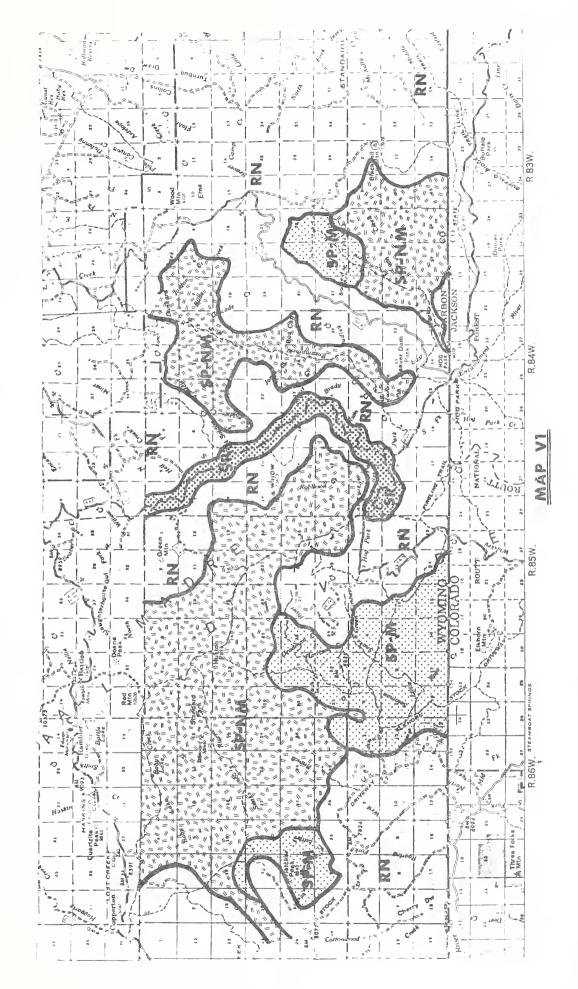
Contents	Page
Recreation Opportunity Table V-1	V-2
Recreation Opportunity Map V-1	° V−3
Recreation Opportunity Map V-2	V-4
Effects of Stage II on Potential Wilderness Table V-2	V <b>-</b> 5
Further Planning Rare II Areas	V-8
Soil Property Table Table V-3	V-9

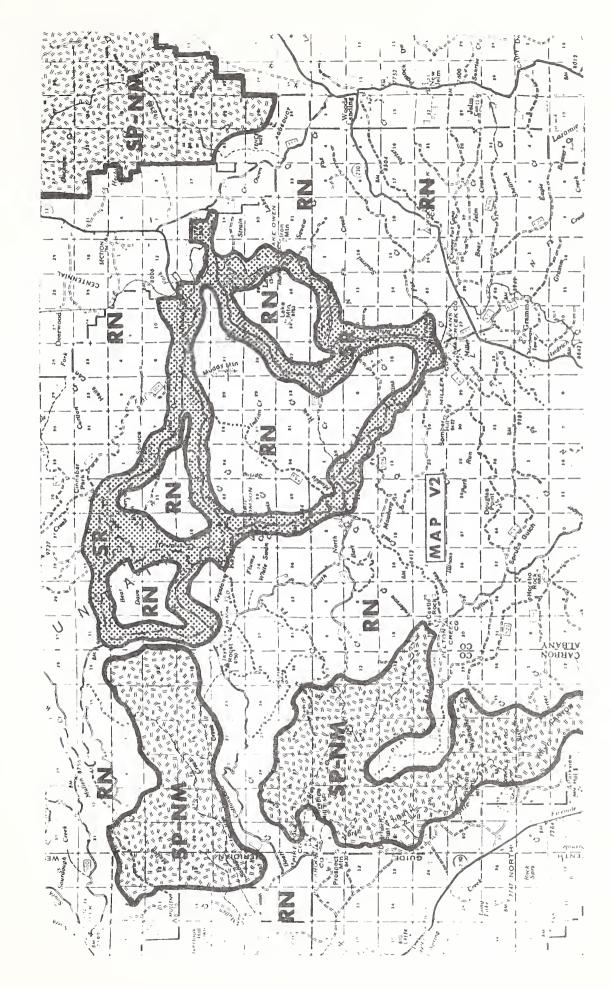
•	

TABLE V-1

The following table displays the changes in acreage of various dispersed recreation opportunities anticipated as a result of each alternative.

rnativ	tage II as sed with ation. odify Stage Stage II sion only st Branch. st Branch. odiversion reservoir Vorth Fork ttle Snake	A. North Platt Boat Pump Platt Boat Platt Boat Pump Platt Boat Pla	tve no -4100 -20004100 -4100 -4100	ive no -4300 -4300 -4300 -4300 -4300 -4300	al - Acres change +6200 +4100 -1500 +7000 +7000	no - Acres change +2200 +2200 +4200 +1400 +1400 +1400
	V - 2	Recreation Opportunity Spectrum	Semi-Primitive Non-Motorized - Acres	Semi-Primitive Motorized - Acre	Roaded Natural - Acres	Rural - Acres





EFFECTS OF STAGE II ON POTENTIAL WILDERNESS TABLE V-2

									4	चीन चारत	0	2	8	often	>	0	8												
		A.	No	No Action		B. dai bac	St Pro ily ck.	tage opos	II sed	C. Sta Wes	M M M	dif II II 3ran	y	D, W/R in For	St Res. Nor rk	ag th	e II ump	E. F from Park Pole		ump Hog to Mtn.		F. fro	Pul om B Pol	Pump Boat	Cr tn.	G. from gate Mtn.	ea.	ump North to Po	h- ole
Roadless Area		e River	.viA Jnemq	n Park-W	n Park er Pln.	6 KIAGL (	.viA Jnemq	n Park-W	er Pln.	e River	.viA Jnemq	п Ратк-W	n Park er Pln.	e River	.viA Jnemq	n Park-W	er Pln. er Pln.	e River	pment Riv.	n Park-W	n Park er Pln.	e River	.viA Jnemq	n Park-W	n Park er Pln.	e River	viA Juəmqı	п Ратк-И	n Park er Pin.
Effects		platt	Епсаш		disuH Mirth	Platt	Епсаш		Husto Husto		Епсаш		Husto		Епсаш	ojsnH	kurth Husto	Platt	Епсаш		Husto Husto	Platt	Епсаш	oısnH	Furth Husto	Platt	Епсаш		Furth
Acres Available For Wilderness		0	0	0	0	0	0		- 10		0		-3		0	0	0	0	0	0	-10	0	0	0	-10	0	0	0	-10
Decreased Water Flows in Area		0	0	0	C	+2	0	0	-4	+2	0	0	3/	+2	C	0	0	0 /4	0	0	13/	0/4/	0	0	-4 3/	0/4/	0	0	3/
Increased Water Flows in Area		0	0	0	С	+2	-2	0	0	+2	-2	0	0	+2	-2 6/	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Fishery		0	0	0	0	+1	-2	0	-2	+1 5/	-2	0	디	+1	-2  -2	0	0	0	0	0	-2	0	-2	0	-2	0	-2 <u>6</u> /	0	-2
Overall Natural Environment	ıt	0	0	0	0	+1	-2	0	-5	0	-2	0	-2	0	-2	0	0	-1	-1	0	-5	-	-2	0	-5	0	-2	0	-5
Wilderness Solitude		0	0	0	0	0	0	-	-5	0	0	-1	-2	0	0	0	0	-1	-1	-1	-5	<u>-</u>	0	-1	-5	0	0	-1	-5
Trailheads and Wilderness Access		0	0	0	0	0	0	+3	×	0	0	+2	+	0	0	0	0	0	0	+3	X	0	0	+3	×	0	0	+3	×
Subtotal b Area	by	0	0	0	0	9+	9-	+2	-26	+5	9-	+	6-	+5	9-	0	0	-2	-2	+2	-26	-2	-4	+2	-26	0	7-	+2	-26
Total by Alternative	7e		0				-2	54			6-					7			1	28			-3	30			-2	စ္သ	

Approximately 75 miles of Douglas Creek could be adversely affected 1/ by reduced flows through the area proposed for wilderness. The amount and timing of the reduced flows are dependent upon mitigation measures for water release from Rob Roy Reservoir and diversions out of Douglas Creek into the Lake Owen pipeline. The proposed wilderness boundary is located about 12 miles downstream from Rob Roy reservoir and the point of diversion. Tributary streams to Douglas Creek between these points represent about 75 percent of the normal flow of water as it enters the proposed wilderness. Stage I mitigation provides for a minimum flow release of 1 cfs at the pipeline diversion. Stage II mitigation will provide for a minimum of  $5\frac{1}{2}$  cfs. With this minimum flow release, Douglas Creek will be very close to normal during the recreation use period of June through October. Effects on riparian vegetation, naturalness and scenery would be insignificant.

If the  $5\frac{1}{2}$  cfs minimum flow is not ensured, or if high releases are made out of Rob Roy Reservoir without diversion into the pipelines, flows on Douglas Creek could be subject to unnatural fluctuations not acceptable to wilderness management. A rating of -8 would be more appropriate to that situation.

- Would affect about 4 miles of natural stream in the West Branch and Rabbit Creek below the points of diversion. With minimum flow releases during the low water season, which is also the primary use season, the effects on wilderness environment would be minor; however, the development itself would disqualify a 1430 acre part of the area from further wilderness consideration anyway.
- 3/ Would affect about 10 miles of natural streams in the West Branch, Rabbit Creek and Roaring Fork below the points of diversion. The development itself would disqualify the entire 5210 acre area from further wilderness consideration anyway.
- These alternatives would not modify the Stage I operation of Rob Roy Reservoir and Douglas Creek. The minimum flow at the point of diversion would remain at 1 cfs. This eliminates the opportunity to improve mitigation measures as described in 1/ above.
- 5/ These alternatives would modify the Rob Roy Reservoir capacity and operations to provide for increased minimum flow releases as described in 1/ above and would therefore have beneficial effects on natural streamflows and the fishery.

Based on a daily payback of water, increased flows on 1/8 mile of 6/ Hog Park Creek within the proposed wilderness (just above confluence with the Encampment River) would exceed bank capacity (see Stewart report). This would adversely affect streambank stability and the natural fishery of this segment of stream. The Encampment River is capable of handling these increased flows (Stewart Report), and the effects on wilderness character would be very minor. With provision for a 10 or 12 month modified release payback (Banner Report V-9), the modified water flows in Hog Park Creek and the Encampment River could actually be beneficially reducing peak flows and increasing low flow rates. Should this happen, the rating would more appropriately be a +5. Another mitigating option would be to pipe the increased flows from Hog Park Reservoir to the Encampment River of Commissary Park. This would avoid these adverse effects on the proposed Encampment wilderness, and with properly regulated releases into Hog Park Creek, could benefit these wilderness characteristics.

A. RARE II AREAS THAT COULD BE AFFECTED BY THE PROPOSAL PLATTE RIVER C2080; 20,262 ACRES

No stage II water diversion developments are actually proposed within the Platte River area, but additional water diversions out of Douglas Creek by raising of the Rob Roy Reservoir, as well as additional water diversions out of the headwaters of the tributary streams of Muddy Creek and Lake Creek are proposed. This will cause a diminished stream flow in Douglas Creek on the 7½ miles that flow through the proposed North Platte Wilderness area in addition to the diversions now being done by Stage I developments. Alternative F, which proposed pumping water out of the North Platte River near Boat Creek would require a pipeline and three pumping stations to cross just north of the proposed wilderness boundary. It is anticipated that this pipeline would be near the existing corridor of the Platte River access road and would not directly effect the existing or proposed wilderness areas.

### B. ENCAMPMENT RIVER - 02086; 10,365 ACRES

No Stage II water diversion developments are proposed within the Encampment River area, but increased water flows would result from the replacement water being released down Hog Park Creek into the Encampment River. The increased flows would effect 1/8 mile of Hog Park Creek and  $6\frac{1}{2}$  miles of the Encampment River within the area recommended for wilderness. The potential effects of increased flows from Stage II, in addition to the increased flows from Stage I development, will be dependent upon the water repayment schedule and mitigation measures of the various alternatives considered.

#### C. HUSTON PARK - A2087; 31,485 ACRES.

No Stage II water diversion developments are proposed within the Huston Park area; however, the gravity system of additional diversions from the Little Snake River drainage will be adjacent to the south boundary of the proposed Huston Park Wilderness area.

D. HUSTON PARK C2087; (Further Planning) 5,210 acres allocated to Further Planning in RARE II and in the Supplement to the Huston Park Unit Land Management Plan (FES 9/1/78). The management direction of that plan for Management Unit IV (C2087) is that it could either be available for development or as an addition to the proposed wilderness area, depending upon the outcome of the Stage II project assessment. If the decision is to allow expansion of Stage II into all or part of area C2087, then this area will no longer be considered for addition to the proposed wilderness and the recreation opportunity class will change from semi-primitive, non-motorized to semi-primitive, motorized or roaded natural, depending on changes in road access.



SOIL PROPERTIES AND INTERPRETATIONS CHEYENNE WATER DIVERSION PROJECT

Table V-3

REVEGETATION POTENTIAL	High	High	High	Mod.	Mod.	Mod.	High	Mod.	Mod.	High	Mod.	Mod.	Low	Low	Low	Low	
MASS MOVEMENT HAZARD	Low	Low	Low	Low	. род	Low	Low	Low	Mod.	Low	Low	. Mod.	High	Low	Low	Mod.	
TOPSOIL STRIPPING DEPTH (INCHES)	09	09	301	301	241	301	301	301	181	30	30	24	18	61	61	61	
% COVER NEEDED TO MEET SOIL LOSS TOLERANCE AT AVE. SLOPE	7	50	2	35	65	35	20	53	67	20	52	29	75	31	63	77	
SOIL LOSS TOLERANCE (TONS/ACRE)	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	7
AVAIL. MOIS. PLANT GROWTH (IN INCHES)	13.2	13.2	8.6	8.6	9.8	9.8	9.9	9*9	9*9	9*9	9.9	9.9	9.9	0.8	0.8	8.0	750 17
SLOPE	0-10	10-25	0-10	10-25	25-40	10-25	0-10	10-25	25-40	0-10	10-25	25-40	+0+	0-10	10-25	25-40	
SOIL MAPPING UNIT	317A	319B	449A	449B	449C	499B	628A	628B	628C	629A	629B	629C	629D	633A	633B	6330	

1 These soils have more than 35% coarse fragments.



SOIL PROPERTIES AND INTERPRETATIONS CHEYENNE WATER DIVERSION PROJECT

Table V-3

TIMI SULPHADE	2012	AVAIL. MOIS. PLANT GROWTH	SOIL LOSS TOLERANCE	% COVER NEEDED TO MEET SOIL LOSS TOLERANCE AT AVE.	TOPSOIL STRIPPING DEPTH	MASS MOVEMENT	REVEGETATION POTENTIAI
					1		
638A	0-10	2.2	2	22	12	Low	Mod.
638B	10-25	2.2	2	55	121	Low	Low
6380	25-40	2.2	2	70	61	Mod.	Low
638D	+0+	2.2	2	77	61	High	Low
639A	0-10	2.2	2	22	121	Low	Low
639B	10-25	2.2	2	5.5	121	Low	Low
26E9 -1	25-40	2.2	2	70	121	Mod.	Low
639D	+07	2.2	2	77	61	High	Low
659B	10-25	11.0	2	50	481	Low	Mod.
833A	0-10	4.5	2	0	241	Low	Mod.
833B	10-25	4.5	2	30	241	Low	Mod.
833C	25-40	4.5	2	57	241	. Mod	Low
833D	+0+	4.5	2	53	121	High	Low
928D	+0*	9*9	2	07	181	Mod.	Low
1000D	+07	9*9	2	99	61	High	Low
1004AB	0-25	10.2	2	26	121	Low	High

<sup>1</sup> These soils have more than 35% coarse fragments.



SOIL PROPERTIES AND INTERPRETATIONS CHEYENNE WATER DIVERSION PROJECT

Table V-3

	REVEGETATION POTENTIAL	Mod.	Low	Low	Low	Mod.	Mod.	Mod.	Low	Mod.	Mod.	Mod.	Low	Mod.	Low	
	MASS MOVEMENT HAZARD	Mod.	High	Low	Low	Low	Mod.	Low	Mod	Low	Low	Mod.	High	Low	Mod.	
	TOPSOIL STRIPPING DEPTH (INCHES)	121	0	0	0	301	301	30	09	9	241	241	181	24	24	
)	% COVER NEEDED TO MEET SOIL LOSS TOLERANCE AT AVE. SLOPE	72	81	58	72	50	72	57	50	32	42	57	65	50	65	
	SOIL LOSS TOLERANCE (TONS/ACRE)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	AVAIL. MOIS. PLANT GROWTH (IN INCHES)	8.6	8.6	1.2	1.2	9.9	9*9	9.9	10.6	10.8	3.3	3.3	3.3	6.6	6.6	
	SLOPE	25-40	+0+	10-25	25-40	10-25	25-40	10-25	25-40	0-10	10-25	25-40	+0+	10-25	25-40	
	SOIL MAPPING UNIT	1006C	1006D	1008B	1008C	1010B	- 1010c	1011B	1012C	1013A	H128B	H128C	H128D	H158B	H158C	

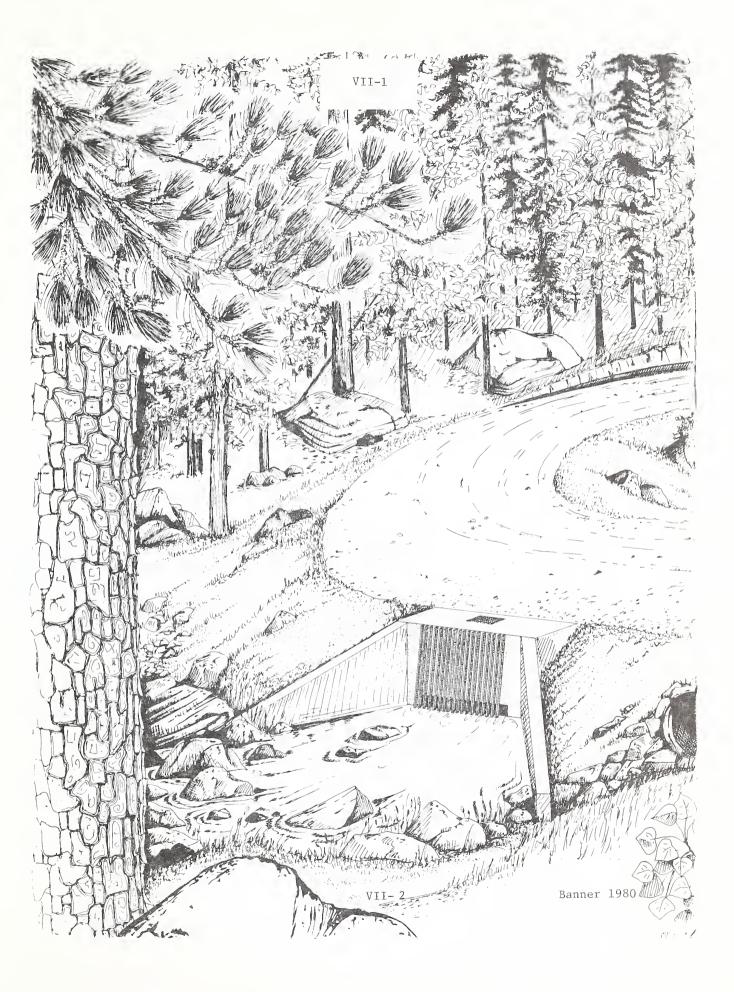
1 These soils have more than 35% coarse fragments.



### APPENDIX VII

Contents		Page
Figure VII-1	Diversion Structure Conceptual Design - Large	VII-2
Figure VII-2	Diversion Structure Conceptual Design - Small	VII-3
Table VII-3	Recommended Instream Flows	VII-4







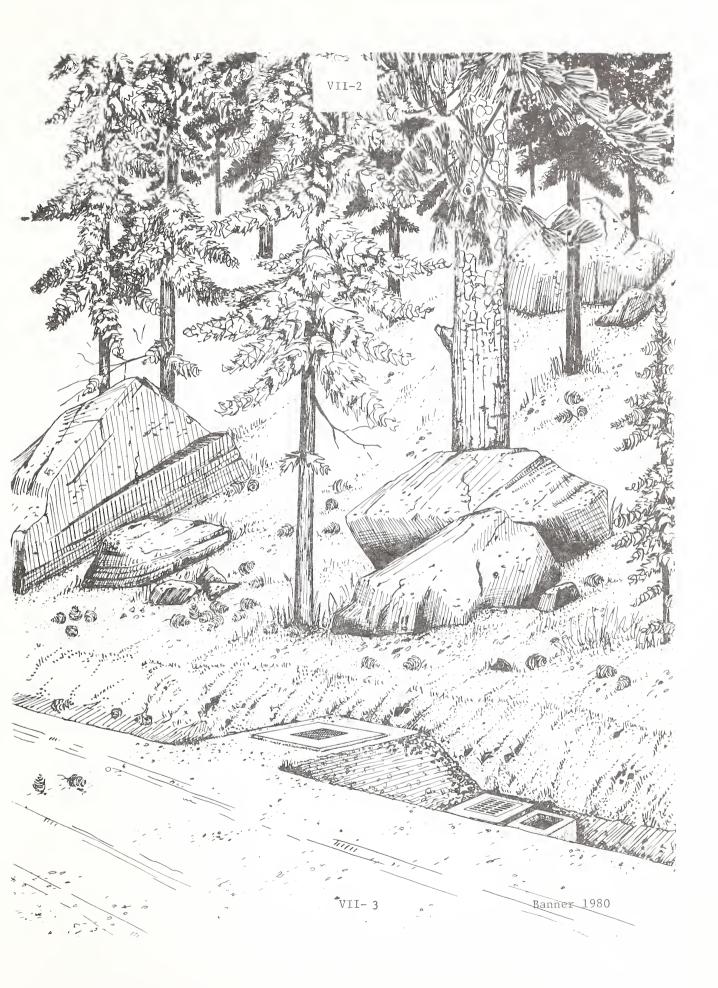




TABLE VII 3

RECOMMENDED INSTREAM AND FLUSHING FLOWS

Stream	Intream Flow (cfs)	Flushing Flow (cfs)
Rose Creek	0.75	9.0
Green Timber Creek	1.0	14.0
North Fork	2.0	30.0
Ted Creek	1.0	19.0
Third Creek	1.0	11.0
Deadman Creek	2.0	35.0
Harrison Creek	1.0	9.0
Solomon Creek	1.0	12.5
Rabbit Creek	1.5	18.0
West Branch	3.5	92.0
Roaring Fork	1.0	31.5
Sherard Creek	0.5	12.0
Douglas Creek	5.5	130.0
Nugget Gulch Creek	0.2	4.5
Little Beaver Creek	0.35	7.0
Camp Creek	0.2	2.0
Lake Creek	0.5	8.5
Horse Creek	0.2	_



## APPENDIX VIII

Contents	Page
Table VIII-l Potential Water Development Reservoirs in Yampa River Basin	VIII-2
Exhibit VIII-1 Enrolled Act 43 Cheyenne Water Bill	VIII-3
Section 1 Watershed Input	VIII-11
Section 2 Fisheries Input	VIII-18
Section 3 Soils Input	VIII-42
Section 4 Wildlife Input	VIII-49
Section 5 Landscape Input	VIII-56
Section 6 Transportation Input	VIII-60



POTENTIAL WATER DEVELOPMENT RESERVOIRS IN YAMPA RIVER BASIN

Date of Decree	6/59/59	8/1/62		:	:		:	:	4/28/67	1/22/61	2/56/63	8/1/62	6/4/63	6/24/64	:	
ادّة	/9	/8							4	//	2/	/8	· /9	/9		
Decree Held by	CRWCD	CRWCD		CRWCD	CRWCD	3	ر ا	VTC	RMPC	J.E. Luttrell	CRWCD	9 ASCP		CUEA	CRNCD	
Principal Use	Irrigation	Irrigation		Irrigation	Irrigation	c	Lower over	Power	Power	Irrigation	Irrigation	Irrigation	Irrigation	Power (?) CUEA <sup>7</sup>	Irrigation CRNCD	
Capacity Acre-feet	43,200 (53 million m <sup>3</sup> )	12,100 (15 million m <sup>3</sup> )		60,000 (74 million m <sup>3</sup> )	15,500 (19 million m <sup>3</sup> )		32,500 (40 million m <sup>3</sup> )	12,500 (15 million m <sup>3</sup> )	23,300 (29 million m <sup>3</sup> )	15,300	9,000 (11 million m <sup>3</sup> )	31 800	79,300 3)	8,600 3)	43,200 3)	
Project Name	Pleasant Valley	Rampart	Savery-Pot Hook	Pot Hook Res.	Sandstone Res. (in Wyoming)	Sheephorn*	Yampa Kiver Kes.	Morrison Creek Res.	Trout Creek	Twenty Mile 3 (19 million m <sup>3</sup> )	Yamcolo	Yellow Jacket*	Grouse Mountain	Hayden	Woodchuck	
Map Key	15	16		17	18	9	5	50	21	22	23	24	2 2	56	27	
Date of Decree	9/30/61	8/1/62	:	7/20/63	8/4/64		6/8/54	12//74		1/16/66	6/25/64	1/16/66	:	1	1/16/77	1/16/77
Decree Held By	CRWCD <sup>1</sup>	CRWCD	UC&MC <sup>2</sup>	PSC <sup>3</sup>	PSC <sup>3</sup>		CRWCD	CRWCD		RMPC <sup>4</sup>	RMPC	RMPC	RMPC	RMPC	RMPC	RMPC
Principal Use	Irrigation	Irrigation	Power	Irrigation	Power		Power	Power		Power	Power	Power	Power	Power	Power	Power
Capacity Acre-feet	11,600 (14 million m <sup>3</sup> )	36,000 (44 million m <sup>3</sup> )	44,500	(55 million m )	(/0 million m <sup>-</sup> ) 44,000 (54 million m <sup>3</sup> )	ntain	1,080,000	142,000	(175 million m <sup>2</sup> )	229,000 (282 million m <sup>3</sup> )	24,200 (30 million m <sup>3</sup> )	84,000 (104 million m <sup>3</sup> )	25,200 (31 million m <sup>3</sup> )	102,200 (126 million m <sup>3</sup> )	103,200 (127 million m <sup>3</sup> )	22,000
Project Name	Bear	California Park	Craig	Dunckley	Hinman Park	Juniper-Cross Mountain	Juniper Res.	Cross Mountain	Res. Oak Creek	Blacktail Res.	Childress Res.	Lower Green Creek Res.	Lower Middle Creek Res.	Upper Middle Creek Res.	Main Green Creek Res.	Service Creek
Map Key	_	2	3	4	2		9	7		8	Ø	10	7	12	13	74

1Colorado River Water Conservation District 2Utah Construction and Mining Company 3Public Service Company of Colorado 4Rocky Mountain Power Company

Svidler Tunnel Company and City of Golden Fyellow Jacket Conservancy District 7 Colorado Ute Electric Association \*Project involves other reservoirs outside of Yampa Basin

NATIONAL PARK SERVICE GRIEN & YANPA RIVERS WILD AND SCENIC DEIS JUNE 1979



ENROLLED ACT NO. 43, HOUSE OF REPRESENTATIVES

FORTY-FIFTH LEGISLATURE OF THE STATE OF WYOMING 1980 SESSION

AN ACT to create W.S. 41-2-209 through 41-2-211 relating to Stage II and Stage III of the Little Snake River water management project; providing for the design and construction of a portion of Stage II; providing for a grant of money from the Wyoming water development account; providing for a loan of money from the permanent mineral trust fund to the city of Cheyenne; providing for the completion of the study of Stage II as provided by W.S. 41-2-204(a)(iii); providing for a study of Stage III including the in-basin needs of the Little Snake River Basin; providing for city, town and special district contributions to the study; providing for an appropriation; and providing for an effective date.

## Be It Enacted by the Legislature of the State of Wyoming:

Section 1. W.S. 41-2-209 through 41-2-211 are created to read:

# 41-2-209. Authorization for the construction of Stage II of the Little Snake River Water Management Project.

- (a) The department of economic planning and development is authorized to proceed with the construction of Stage II of the Cheyenne Little Snake Diversion Facilities in south-central Wyoming. Stage II is specifically defined in W.S. 41-2-204(a)(ii) and (iii). Prior to the commencement and construction of the project, the department of economic planning and development shall:
- (i) Enter into a signed project agreement, in a form acceptable to the Wyoming attorney general, with the city of Cheyenne, Wyoming, for the construction, operation and maintenance of the project by the city as specified in W.S. 41-2-209 through 41-2-211;
- (ii) Approve the final design, plans, specifications and construction schedules for the project facilities and development of the water supplies, construction of new interception lines, collection, storage and transmission facilities;

ENROLLED ACT NO. 43, HOUSE OF REPRESENTATIVES

FORTY-FIFTH LEGISLATURE OF THE STATE OF WYOMING 1980 SESSION

- (iii) Approve changes, analysis and plans of the city of Cheyenne for establishing, operating and maintaining the project; and
- (iv) Prepare and obtain conveyances and approval by the state engineer of all water rights and permits from the city of Cheyenne to the state in connection with Stage III of the Little Snake River water management project. Stage III is specifically defined in W.S. 41-2-204(a)(iv) and (v) which conveyances shall be held in escrow until all of the Stage II project has been funded, at which time the documents shall be released to the state.
- 41-2-210. Projects authorized; state grant; permanent mineral trust fund loan.
- (a) The following construction is authorized within the Stage II project:
- (i) Enlargement of Rob Roy Reservoir, estimated to cost eighteen million dollars (\$18,000,000.00);
- (ii) Little Snake River collection system, estimated to cost twenty-five million dollars (\$25,000,000.00);
- (iii) Enlargement of Hog Park Reservoir, estimated
  to cost thirteen million dollars (\$13,000,000.00);
- (iv) Hog Park to Encampment River pipeline, estimated to cost two million dollars (\$2,000,000.00).
- (b) The projects enumerated in subsection (a) of this section shall be financed as follows:
- (i) The city of Cheyenne shall finance the total cost of the project under paragraph (a)(i) of this section and one-half (1/2) of the total cost of the projects under paragraphs (a)(ii), (iii) and (iv) of this section as provided by

ENROLLED ACT NO. 43, HOUSE OF REPRESENTATIVES

FORTY-FIFTH LEGISLATURE OF THE STATE OF WYOMING 1980 SESSION

subsection (c) of this section;

- (ii) The state shall finance one-half (1/2) of the total cost of the projects under paragraphs (a)(ii), (iii) and (iv) of this section as provided by subsection (d) of this section.
- (c) The Wyoming farm loan board with the advice of the executive director of the department of economic planning and development is authorized to loan not more than forty million dollars (\$40,000,000.00) from the permanent mineral trust fund to the city of Cheyenne or as much thereof as deemed necessary by the department of economic planning and development to design and construct the portion of Stage II of the Little Snake River water management project provided by subsection (a) of this section. The revenue shall not be advanced until:
- (i) The qualified electors of the city of Cheyenne approve creation of debt totaling forty million dollars (\$40,000,000.00) and approve the pledging of the revenue from the operation of the water project as the primary source of repayment of the debt as evidenced by the issuance of general obligation bonds to the state of Wyoming;
- (ii) The city of Cheyenne submits a financing plan designed to reimburse the state of Wyoming subject to the following specific conditions:
- (A) The city will pay interest charges computed at a rate which will be no more than one-half percent (.5%) below the rate for which the city of Cheyenne could sell the general obligation bonds on the open market, and shall not be less than five percent (5%) per annum. This rate determination shall be made by the farm loan board;
- (B) Principal payments may be deferred on request of the city with the approval of the farm loan board but not beyond the original final payment date set by the farm loan board;

ENROLLED ACT NO. 43, HOUSE OF REPRESENTATIVES

FORTY-FIFTH LEGISLATURE OF THE STATE OF WYOMING 1980 SESSION

- (C) The city shall apply available revenue from secondary sources of revenue, designated within the financing plan, to the repayment of the loan.
- (iii) The city agrees not to sell water except as provided by W.S. 41-2-210(e) outside its service area without prior approval of the state engineer and the water development commission;
- (iv) A rate study is conducted for the city by a professional municipal finance and rate firm;
- (v) The city agrees to mortgage to the state all facilities constructed with funds provided by the farm loan board and assign all easements, right-of-way, water rights and permits as approved by the state engineer appurtenant thereto, in such form and to such extent as is required by the Wyoming attorney general. The conveyances shall be held in escrow. The state engineer shall not change the priority date of the water rights and permits as a result of this conveyance or escrow. Upon payment in full of the loan to the state of Wyoming, the conveyances shall be returned to the city of Cheyenne; and
- (vi) The city agrees that any water sold to an industrial user by the city of Cheyenne shall be sold for a minimum rate which shall be calculated as the cost of service plus a pro-rata share of all the capital and interest costs of this project if the interest rate were ten percent (10%) and were due on the grant as well as the loan. This minimum rate shall apply only to water which is in excess of one thousand (1,000) acre feet annually of the average use of city of Cheyenne water of that industrial user for the years 1975 to 1979 inclusive. The revenue resulting from the difference between this rate and the residential water rate shall be used to accelerate repayment of the loan.
- (d) The state treasurer shall pay not to exceed twenty million dollars (\$20,000,000.00) from the Wyoming water develop-

ENROLLED ACT NO. 43, HOUSE OF REPRESENTATIVES

FORTY-FIFTH LEGISLATURE OF THE STATE OF WYOMING 1980 SESSION

ment account provided by W.S. 39-6-305(g) to the city of Cheyenne as deemed necessary by the department of economic planning and development as provided by paragraph (b)(ii) of this section. The payments are grants and not loans to the city of Cheyenne and shall not:

- (i) Be disbursed until the loan pursuant to W.S. 41-2-210(c) is fully obligated;
- (ii) Deplete the balance remaining within the Wyoming water development account to less than ten million dollars (\$10,000,000.00) for projects listed within W.S. 41-2-210(a);
- (iii) Be disbursed until the city of Cheyenne, in consultation with the farm loan board and the department of economic planning and development, develops a proposed financing plan for funding the completion of the Stage II water project as defined in W.S. 41-2-204(a)(ii) and (iii). Copies of the plan shall be mailed to the governor and members of the legislature. This provision shall not be construed as requiring any approvals of such a financing plan.
- (e) All water in excess of the needs of the city of Cheyenne within the service area of the city produced by Stage II of the project shall be marketed by the city and proceeds thereof shall be applied to the repayment of the loan under subsection (c) of this section. The first option to purchase not more than eighty percent (80%) of the surplus water shall be extended to cities, towns and special districts, who had contributed to a feasibility study of the Stage III water project, for the benefit of their inhabitants at a cost of twenty-five cents (\$.25) per thousand (1,000) gallons. The amount of water available to each city, town or special district shall be determined by the department of economic planning and development.
- (f) Any city, town, or special district purchasing water from the development of Stage II shall agree to charge any industrial user a minimum rate which shall be calculated as the

ENROLLED ACT NO. 43, HOUSE OF REPRESENTATIVES

FORTY-FIFTH LEGISLATURE OF THE STATE OF WYOMING 1980 SESSION

cost of service plus a pro-rata share of all the capital and interest costs if the interest rate were ten percent (10%) and were due on the grant as well as the loan. This minimum rate shall apply only to water which is in excess of one thousand (1,000) acre feet annually of the average use of water from that city, town, or special district of that industrial user for the years 1975 to 1979 inclusive. The revenue resulting from the difference between this rate and the residential water rate shall be paid to the state of Wyoming to accelerate the repayment of the loan to Cheyenne from the permanent mineral trust fund.

# 41-2-211. Approval of project expenditures; state engineer duties.

- (a) After commencement of design and construction of the project and until completion, the department of economic planning and development shall approve expenditures for project engineering and construction. The city of Cheyenne shall provide to the director of the department of economic planning and development monthly progress reports confirming that the construction, design and specifications for the project are being followed and complied with.
- (b) The state engineer shall conduct a study based on records available from prior years and actual measurements to determine the level of water at the Dixon measuring station required to satisfy water rights senior to the rights of the city of Cheyenne. He shall use the results of this study to aid in the regulation of the Little Snake River drainage provided that the result does not give junior rights priority over senior rights.
- Section 2. There is appropriated from the Wyoming water development account of the state of Wyoming to the Wyoming water development commission the sum of four hundred thousand dollars (\$400,000.00), or so much thereof as may be necessary, to pay the cost and expenses of preparing a feasibility study and providing for preliminary engineering plans and development pro-

ENROLLED ACT NO. 43, HOUSE OF REPRESENTATIVES

FORTY-FIFTH LEGISLATURE OF THE STATE OF WYOMING

1980 SESSION

grams and submitting of draft legislation to the 1981 session of the legislature in connection with Stage III of the Little Snake River Water Management Project. Stage III is specifically defined in W.S. 41-2-204(a)(iv) and (v). As part of the Stage III feasibility study, the Wyoming water development commission shall conduct a study of a reservoir or reservoirs to provide water for agricultural and municipal users in the Little Snake River Basin. Any city, town or special district may contribute up to fifty thousand dollars (\$50,000.00) to be used for the study in lieu of a like amount of the state appropriation and by so contributing shall be assured a share of the Stage project which the contribution bears to two hundred thousand dollars (\$200,000.00) and shall purchase for twenty-five cents (\$.25) per one thousand (1,000) gallons any surplus water not usable by the city of Cheyenne from the development of Stage II water project as provided by W.S. 41-2-210(e). If the Stage III project is authorized by the Wyoming legislature, the water rights to the Stage III project conveyed to the state under W.S. 41-2-209(a)(v) shall be conveyed without change of priority date to the cities, towns and special districts contributing to the study in accordance with their respective interests and subject to financing requirements the Stage III project shall be constructed and operated by the participating cities, towns and special districts.

Section 3. In connection with the completion of Stage II of the Little Snake River water management project the water development commission shall study the feasibility of constructing in the Little Snake River drainage, above the confluence of the river and Savery Creek, a reservoir of at least three thousand (3,000) acre feet and the reservoir shall satisfy immediate in-basin agricultural, recreational and municipal needs and shall promote in-basin water purity. In connection with the completion of the State II study of the project, draft legislation shall be submitted to the 1981 session of the legislature.

ENROLLED ACT NO. 43, HOUSE OF REPRESENTATIVES

FORTY-FIFTH LEGISLATURE OF THE STATE OF WYOMING 1980 SESSION

Section 4. This act is effective immediately upon completion of all acts necessary for a bill to become law as provided by Article 4, Section 8 of the Wyoming Constitution.

(END)

Speaker	of	the	House		 President	of	the	Senate	3
				Governor					
			TIME	APPROVED:					
			DATE	APPROVED:					

WATERSHED
PROPOSED
CHEYENNE STAGE II
EXPANSION DATA

Pete Stewart Hydrologist Medicine Bow National Forest



#### SECTION 1

# EIS INPUTS TO CHEYENNE DIVERSION WATERSHED

#### A. PERMITS

A 404 Dredge and Fill Permit (404 section of the Clean Water Act of 1977) from the Corps of Engineers for a number of activities associated with the proposed Stage II development will be necessary. The specific sites and the number of permits necessary vary with the alternative.

#### B. AFFECTED ENVIRONMENT

With respect to water quality there are two parameters that have potential for being adversely effected. They are turbidity and salinity. All of the six action alternatives will have temporary increases in turbidity in waters adjacent to areas of soil disturbance. The degree and length of increases in turbidity will depend upon the effectivness of erosion control measures and the success of post-construction revegetation efforts. (See open file report on "Water Quality Impacts")

Alternative A (no action) would generate the least amount of turbidity and Alternative D (lower reservoir) would produce the most.

With the exception on the no action alternative, the effects on salinity will be identical with all six of the action alternatives because the same amount of water will be diverted out of the Little Snake River drainage (16,000 - 20,000 acrefeet assuming an average runoff year, an 80% diversion structure efficiency and bypassing of instream, flushing and blanket flows). The salinity concentration will be raised by an estimated 1.73 mg/L at Imperial Dam on the Colorado River. Salinity assessments were made at several intermediate points in the Little Snake and Yampa Rivers. (See salinity impacts in open file).

Water quantity will be affected by all six of the action alternatives. Diversion structures would be constructed in both the Little Snake (repayment water to the North Platte System) and Douglas Creek (water that actually reaches the City of Cheyenne) drainages with Alternatives B, C, and D. Alternatives E, F, and G would involve diversions in the Little Snake River drainage only. (See open File reports on diversion impacts for the Little Snake and Douglas Creek drainages.)

There would be augmented flows for five of the action alternatives (B, C, D, F, and G.) These augmented flows could have impacts on Hog Park Creek and the Encampment River depending upon the water payment schedule implemented. (See open file report on augmented flows).

3. Page 6 VI Criteria (2) Resource Mgt. Concerns (a) Watershed See previous section

#### C. CRITERIA

- Reservoir fluctuation Reservoir fluctuation on Hog Park with a day to day
  payback schedule or any of the three repayment plans
  would not cause significant changes in the water level
  during the recreation season (June 15 to Sept. 15) in an
  average or better runoff year. Draw down would not occur
  until after the recreation season in an average year with
  proper management.
- 2. State Water Quality Standards -Water Quality Rules & Regulations Chapter 1, "Quality Standards for Wyoming Surface Waters" published by the Wyoming Department of Environmental Quality, states, with respect to turbidity, "In all Class I and II waters the discharge of substances attributable to or influenced by the activities of man shall not be present in quantities which would result in a turbidity increase of more than 10 NTU's. Class I waters within the project area are the main stem of the Encampment River from the U.S. Forest Service boundary upstream to the Colorado State line and the main stem of the North Platte River from the mouth of Sage Creek (approximately 15 stream miles below Saratoga, Wyoming) upstream to the Colorado State line. The remainder of the perennial waters in the project area are Class II because they support a sport fishery. All intermittent drainages are Class IV.

Chapter VI Wyoming Water Quality Rules and Regulations is actually "Water Quality Standards For Salinity Including Numeric Criteria and Plan of Implementation For Salinity Control" for the Colorado River system. This document recommends a flow-weighted average annual numeric salinity criteria for three locations in the lower main stem of the Colorado River. It makes no mention of a salinity standard within Wyoming.

A water quality monitoring program would be established prior to project implementation to establish a data base for the quality of the water at a specific site. This specific site would also be monitored after the project is implemented. All perennial water adjacent to disturbance would be monitored for at least two field seasons after construction is completed. The same water quality monitoring program would be implemented during construction to determine the effectiveness of erosion control measures (Best Management Practices) and to ascertain if State water quality standards are being violated.

Parameters monitored would include but not be limited to dissolved oxygen, temperature, turbidity, suspended solids, and pH.

Salinity at the proposed diversion points is not a problem or an issue. Salinity monitoring will continue in the Little Snake, Yampa, and Colorado Rivers as the salinity issue and problems will continue to persist.

Instream and flushing flows would be checked periodically either with a current meter or by a stage measurement on a control structure.

# D. ALTERNATIVES TO BE CONSIDERED

- 1. Mitigation that would not change by the action alternatives consists of the following:
  - a. Salvaging of topsoil where the quality of soil and land form requires the effort and additional expense. This will enhance revegetation efforts.
  - b. Sediment catchment basins between major areas of disturbance and perennial waterways.
  - c. Lining of perennial waterways with synthetic or natural materials where the channel runs through major areas of disturbance.
  - d. Revegetation efforts may include use of artificial soil, stablization materials, (jute netting and synthetic materials) fertilizer, and hydromulching.
  - e. Riprap material may be necessary in low water crossings on perennial streams.
  - f. Erosion control measures (waterbars in pipeline corridors, and revegetation activities) will be kept current at all times.
  - g. Channelization at diversion location should be kept to a minimum. The channel should be restored to maintain original gradient and water velocity.
- 2. Instream flows below diversion structures to maintain a fishery, aesthetics, and the riparian ecosystem.
- 3. Blanket minimum flows below those diversions in drainages where there is no fishery to provide water for wildlife and maintain the riparian ecosystem.
  - a. Monitoring requirements at specific sites would change by alternative with respect to water quality. However, the intent of a water quality monitoring program which is to monitor the quality of the water in perennial drainages in or adjacent to areas of disturbance, would not change by alternative. The purpose of this

monitoring is to document any changes in water quality caused by the implemented project, comply with State water quality standards, and test the effectiveness of erosion control measures (See Item f).

Offsite impacts to water quality will be monitored through the regular monitoring by the U.S. Geological Survey in their monitoring program in the Little Snake, Yampa, and Colorado Rivers.

Stage II of the Little Snake River Diversion, Havden Division

Supervisor. Medicine Bow National Forest 695 Skyline Drive Laramie, Wyoming 82070

On September 28, 1978, I accompanied Forest Hydrologist Pete Stewart, Richard Ouimet, and Dennis Jespersen on a preliminary field inspection of a portion of the proposed Stage II diversion project on the Little Snake liver. This memorandum documents my observations relative to the potential for snow management measures.

Within the project area, there appears to be little opportunity to auguent streamflow by snow fencing to recover in-transit evaporation losses, due to the limited extent of unforested area. Modest increases in streamflow could be expected from erecting snow fences in the headwaters of Rose Creek, Happy Creek And Rodine Creek, but I would anticipate the magnitude of potential increases to be about 500 acre-feet. Considering the scattered disposition of areas suitable for snow fencing, there is little reason to believe such management techniques would prove cost-effective at the present time.

To explore the complete opportunity for watershed management to augment diversion flow from the Little Snake River drainage. I suggest your project evaluation staff consider arranging for the services of Dr. Charles F. Leaf, consulting watershed management specialist in Fort Collins, Colorado.

ROMALD D. TABLER Principal Research Hydrologist

cc: D. Tackle



# Stage II

Assuming 10,800 acres of watershed in Stage II (all the way to the Roaring Fork)

If the pipeline is stopped at Standard Ck (just west of the West Branch) then 2,485 acres of watershed is lost.

10,800 - 2485 = 8315 acres of watershed in Stage II to Standard Ck.

8315 acres X 2.44 ac ft/ac/year = 20,289 ac ft/year

20,289 acft less 4400 ac ft/year for instream and flushing flows = 15,889 ac ft/year collectable water from Stage II Alt. C.

From conversation with Tim Conner on 4/8/80 the City would put the Ted Ck. diverted water into the Stage II pipeline making more room in the Stage I pipeline. There would also be a short spur line to include Third Creek into the system. There would also be collection points along the pipeline. This total increase amounts to 1770 acres. At 2.44 ac ft/ac/year less instream and flushing flows for Third Creek this comes to an additional 3,846 ac ft/year.

15,889 + 3,846 = 19,735 ac ft/year adjusted collectable water from Stage II - Alt. C

# Stage I

Assuming a 3,800 acre watershed in Stage I at 2.44 acre feet/year this equals 9272 acre feet/year. Instream and flushing flows amount to (Ted, Green, and N. Fork) 2014 acre feet/year which makes a figure of 7258 ac ft/year collectable water form Stage I Alt. C.

7,258 ac ft/year Stage I

19,735 ac ft/year Stage II

26,993 collectable water from Stage I and Stage II, Alt. C.

 $26,993 \text{ X} \cdot .78 \quad (78\% \text{ efficiency}) = 21,054 \text{ ac ft/year}$ 

26,993 X .8 (80% efficiency) = 21,594 ac ft/year

26,993 X . 85 (85% efficiency) = 22,944 ac ft/year

 $26,993 \text{ X} \cdot 9$  (90% efficiency) = 24,293 ac ft/year

The mid range population projection figures from WRRI - November 1979 Report indicates water demand in the year 2000 in Cheyenne would be 22,500 acre ft/year.

FISHERIES CHEYENNE STAGE II STUDY DATA

> Dennis Jespersen Fisheries Biologist Medicine Bow National Forest

CHUVENNY OATA

### A. Listing of Issues

#### 1. Increased Streamflows

Hog Park Creek, Encampment River, Douglas Creek, two streams in the Crow Creek drainage.

#### 2. Decreased Streamflows

Thirty streams in the North Fork and Roaring Fork of the Little Snake River drainage, including the following streams which contain trout populations; Rose Creek, Third Creek, Deadman Creek, Harrison Creek, Solomon Creek, Rabbit Creek, West Branch of the North Fork, Roaring Fork of the Little Snake and Sherard Creek.

Sixteen streams in the Douglas Creek drainage, including the following which have trout populations in the vicinity of the proposed diversion sites; Nugget Gulch Creek, Little Beaver Creek, Camp Creek, and Lake Creek.

## 3. Sensitive Species Habitat

Colorado River cutthroat trout (Salmo clarki pleuriticus) in the North Fork of the Little Snake River drainage.

# B. Management Concerns

#### 1. Effects on Fisheries

Stage II expansion will affect fish populations in three mountain ranges in southcentral and southeastern Wyoming. These fish include Colorado River cutthroat trout (Salmo clarki pleuriticus), brook trout (Salvelinus fontinalis), brown trout (Salmo trutta), and rainbow trout (Salmo gairdneri) in the Sierra Madre Range; brook trout, brown trout, and rainbow trout in the Medicine Bow Range; and brook trout in the Crow Creek drainage on Pole Mountain. Stream, river, and reservoir habitats are involved, with a various range of affects associated with a change in existing fish habitat due to increased and decreased streamflow, Stage II construction, and reservoir enlargement or establishment.

# C. Purpose and Need for Response

# 1. Instream and Flushing Flows

Stream	Instream Flow (cfs)	Flushing Flow (cfs)
Rose Creek	0.75	9.0
Green Timber Creek	1.0	14.0
North Fork	2.0	30.0
Ted Creek	1.0	19.0
Third Creek	1.0	11.0
Deadman Creek	2.0	35.0
Harrison Creek	1.0	9.0
Solomon Creek	1.0	12.5
Rabbit Creek	1.5	18.0
West Branch	3.5	92.0
Roaring Fork	1.0	31.5
Sherard Creek	0.5	12.0
Douglas Creek	5.5	130.0
Nugget Gulch Creek	0.2	4.5
Little Beaver Creek	0.35	7.0
Camp Creek	0.2	2.0
Lake Creek	0.5	8.5
Horse Creek	0.2	0.0

The above recommended instream flows should read "x cubic feet per second, or the natural flow, whichever is less," with the exception of Douglas Creek which is 5.5 cubic feet per second constant flow. All flushing flows are recommended for a 72 hour (3 day) period coinciding with natural peak spring runoff.

In addition to the above recommended flows, a blanket minimum flow on all other Stage I and II streams is recommended. This will require complete bypass of flow when discharge drops to between 0.1 and 0.2 cubic feet per second in midsummer and complete diversion again approximately the first week in November or as long as access to the diversion structures is still possible.

The 10 or 12 month modified release schedule from Hog Park Reservoir as outlined by Banner and Associates (1979) or a pipeline from Hog Park Reservoir to the Encampment River is also imperative to prevent extensive channel damage and corresponding loss of fish habitat in Hog Park Creek (Jespersen, 1980).

#### 2. Problems with Current System

- a. Loss of fish habitat below the existing Stage I diversion structures due to lack of adequate instream flows. This includes sensitive species habitat for the Colorado River cutthroat trout.
- b. Extreme flow fluctuations below the Douglas Creek diversion structure due to poor reservoir management and inadequate reservoir release design.
- c. Introduction of highly turbid water into streams below diversion structures during the annual sediment removal process.

#### D. Fisheries

- 1. North Fork and Roaring Fork of the Little Snake River Drainage
  - a. Historical and Existing Conditions

The Colorado River cutthroat trout is a major concern as it relates to the proposed expansion of the City of Cheyenne's water development project in the headwaters of the Little Snake River. This subspecies is presently classified as "endangered" in Utah, "threatened" in Colorado, and "sensitive" in Wyoming. The American Fisheries Society has recognized the need for protecting the natural habitats of this subspecies and has listed it in the "special concern" category nationwide.

The Colorado River cutthroat trout is indigenous to the North Fork and Roaring Fork drainages of the Little Snake River and historically was the only trout species present in these two drainages. However, these populations have been reduced by competition and hybridization with species which have been introduced into the Little Snake River and many of its tributaries. The competitive ability of the Colorado River cutthroat trout is questionable and this trout does best when other species are absent or at minimal levels (Binns, 1977). Brook trout have almost entirely replaced the cutthroat population in a section of the Roaring Fork sampled by Wesche (1977). Brook trout alone were found in Sherard Creek, a tributary to the Roaring Fork, by Jespersen (1979). The West Branch population of

Colorado River cutthroat trout is extensively hybridized with Rainbow trout (Binns, 1977). Brook trout have also moved up the West Branch and represent a threat to the cutthroat population in this stream and its tributaries. The North Fork and its tributaries above the West Branch contain the largest population of essentially pure Colorado River cutthroat trout remaining (Binns, 1977). These populations have been protected from upstream movement of other species by a fish barrier installed by the Wyoming Game and Fish Department in 1977.

The existing populations of Colorado River cutthroat trout in the North Fork, Ted Creek, and Green Timber Creek have declined from a loss of habitat associated with decreased streamflows since the completion of Cheyenne's Stage I diversion facilities in the early 1960's (Jespersen, 1979). There were no instream flow recommendations established below the Stage I diversion structures in the North Fork of the Little Snake River drainage. These structures annually dry up sections of streams immediately below the diversion with decreasing levels of impact as ground water and small tributaries contribute water downstream. Populations in streams affected by the Stage I diversion structures sampled by Jespersen (1979) revealed trout standing crop estimates ranging from 9.2 to 22.1 pounds per surface acre, while trout standing crops in streams unaffected by Stage I ranged from 29.7 to 62.1 pounds per surface acre.

Low flows below the Stage I diversion structures not only reduce the quantity of available trout habitat as a direct result of less water but also the quality of available habitat due to the relationship between the remaining flow and the stream channel.

# b. Effects Associated with Stage II Expansion

The effects associated with Stage II expansion in the North Fork and Roaring Fork of the Little Snake River drainage highly depend on the implementation of the recommended instream flows, flushing flows, and blanket minimum flows for both Stage I and II streams in this drainage. The affected environment as described below, depends on the assumption that all of these recommended flows will be implemented in the alternatives where appropriate, with the recommended flows for Stage I streams included in all alternatives.

The recommended flows for the proposed Stage II streams were determined to maintain existing fish habitat at present levels and therefore also fish populations. Recommended flows for Stage I streams were determined to reestablish fish habitat at levels which existed prior to Stage I development and provide the opportunity for cutthroat populations to reestablish at previous natural levels. Therefore, assuming these flows are implemented, no predictable change in species present is expected and adverse effect on fish populations should be greatly reduced. There are, however, potential adverse effects associated with the various alternatives which need to be considered. These effects are associated with the building of a reservoir on the lower North Fork or the installation of diversion structures in up to 30 additional streams, 9 of which support trout populations as listed below:

Rose Creek Colorado River cutthroat trout Third Creek Colorado River cutthroat trout Deadman Creek Colorado River cutthroat trout Colorado River cutthroat trout Harrison Creek Solomon Creek Colorado River cutthroat trout Rabbit Creek Colorado River cutthroat trout West Branch Colorado River cutthroat trout Roaring Fork Brook trout Sherard Creek Brook trout

These effects must be considered and are as follows:

- (1) The adverse effects of pipeline and road construction on trout populations, including the addition of sediment to the stream system and the general destruction of trout and macroinvertebrate habitat in the construction zone in each stream.
- (2) The potential decrease in the Colorado River cutthroat population associated with increased access, which will provide a greater opportunity for other fish species and fish diseases to be introduced into cutthroat streams.

- (3) The potential decrease in the Colorado River cutthroat population associated with increased fishermen access and the high vulnerability of this population to the angler.
- (4) The adverse effects of the diversion structures on trout populations including loss of fish into the diversion system and blocking natural fish movement.
- (5) Potential adverse effects associated with a change in the natural flow regime.
- (6) The loss of natural stream habitat to flat water reservoir habitat.
- 2. Hog Park Creek and the Encampment River
  - a. Historical and Existing Conditions

Hog Park Creek contains good populations of brook, brown, and rainbow trout. With the establishment of Hog Park Reservoir during Stage I construction, flows in Hog Park Creek below the reservoir were increased as water was paid back to the North Platte System on a daily basis. Channel stability ratings conducted on Hog Park Creek by Wesche (1977) and Stewart (1979) rated in the "good" category, indicating little if any long lasting detrimental effects associated with this increase in flow. The percentage flow increase in the Encampment River from Stage I water is much less than in Hog Park Creek and therefore not considered significant.

b. Effects Associated with Stage II Expansion

Effects on the fishery associated with Stage II expansion depend on the adoption of the 10 or 12 month modified release schedule described by Banner and Associates (1979), or a pipeline requirement from Hog Park Reservoir to the Encampment River. Without these mitigating measures, extensive stream channel damage in Hog Park Creek is expected (Stewart, 1979), which will also destroy existing fish habitat. There will be a substantial increase in flow in Hog Park Creek with the 10 or 12 month modified release schedules which will change existing trout habitat to some degree; however, no adverse or enhancing effects can be predicted because it is unknown how the trout populations will respond to this change (Jespersen, 1980).

Therefore, assuming the implementation of the 10 or 12 month modified release schedule or a pipeline requirement from Hog Park Reservoir to the Encampment River, no predictable changes in species present or population levels are expected in Hog Park Creek below the reservoir. There will be a loss of natural stream habitat to flat water reservoir habitat above Hog Park Reservoir associated with reservoir enlargement which must be taken into consideration. No adverse change in fish habitat is expected with the addition of Stage II water to the Encampment River (Jespersen, 1980).

# 3. The Douglas Creek Drainage

# a. Historical and Existing Conditions

The Douglas Creek drainage contains good populations of brook and brown trout and a few nongame species. The existing populations of brook and brown trout in Douglas Creek are affected by a loss of habitat associated with decreased streamflows since the completion of Cheyenne's Stage I diversion facilities in the early 1960's. There is also a small section of Horse Creek which was completely dry during the 1979 field season resulting from Stage I diversion. A 1 cubic foot per second flow requirement below the Douglas Creek diversion structure was the only instream flow requirement established for Stage I. This flow is considered very limiting to the trout population in Douglas Creek. In addition to low flows, fish populations in Douglas Creek are subject to extreme flow fluctuations resulting from poor reservoir management which is also considered detrimental to fish and macroinvertebrate populations (Jespersen, 1980). Trout standing crops reported by Wesche (1974) ranged from 7.5 to 183.1 pounds per surface acre at various distances below the Douglas Creek diversion structure. Trout populations sampled in proposed Stage II tributaries of Douglas Creek revealed standing crops ranging from 31.8 to 171.8 pounds per surface acre (Jespersen, 1980).

# b. Effects Associated with Stage II Expansion

The effects associated with Stage II expansion in the Douglas Creek drainage also highly depend on the implementation of instream flows, flushing flows, and blanket minimum flows for both Stage I and II

streams in this drainage. The affected environment as described below depends on the assumption that all of the recommended flows will be implemented in the alternative where appropriate with the recommended flows for Stage I streams included in all alternatives.

The recommended flows for the proposed Stage II streams were determined to maintain existing fish habitat at present levels and, therefore, also fish populations. Recommended flows for Stage I streams were determined to reestablish fish habitat at levels which existed prior to Stage I developement and provide the opportunity for trout populations to reestablish at previous natural levels. Therefore, assuming these flows are implemented, no predictable change in species present is expected and adverse affects on fish populations should be greatly reduced. There are, however, potential adverse affects associated with the various alternatives which need to be considered. These affects are related to the enlargement of Rob Roy Reservoir and the installation of diversion structures in 16 additional streams, 4 of which support trout populations in the vicinity of the proposed diversion site as listed below:

Nugget Gulch Creek
Little Beaver Creek
Camp Creek
Lake Creek

Brook trout
Brook trout
Brook trout
Brook and Brown trout

The effects which must be considered are the following:

- (1) The adverse effects of pipeline and road construction on trout populations including the addition of sediment to the stream system and the general destruction of trout and macro-invertebrate habitat in the construction zone in each stream.
- (2) The adverse effects of the diversion structures on trout populations including loss of fish into the diversion system and blocking natural fish movement.
- (3) Potential adverse effects associated with a change in the natural flow regime.
- (4) The loss of natural stream habitat to flat water reservoir habitat.

#### E. Evaluation Criteria

# 1. Resource Management Concern

#### a. Fisheries

Three assumptions were made in determining the evaluation criteria. If any of these assumptions are violated, the evaluation criteria will need to be reconsidered.

#### It is assumed that:

All recommended instream flows, flushing flows, and blanket minimum flows will be implemented in each case where appropriate;

Either the 10 or 12 month modified release schedule will be adopted or a pipeline required from Hog Park Reservoir to the Encampment River; and

No additional flow will be added to Middle Crow Creek and that flow added to other streams in the Crow Creek drainage will be controllable with a pipeline also going off the forest.

With the above assumptions, no change in species present is expected. This is an important issue however, and was included as an evaluation criteria to show that it was considered. The adverse effects previously listed under the Effected Environment and the potential loss of trout Habitat Units were also chosen as evaluation criteria important in comparing the various alternatives. The evaluation criteria are as follows:

# 1) Species Present - Importance High

This category is included to show that with the flow recommendations, no change in species present is expected. There is, however, an increased potential for the loss of one or more pure strain Colorado River cutthroat trout streams from the introduction of other species associated with greater access.

2) Trout Habitat Units Lost - Importance High

This category is based on the Wyoming Game and Fish Department Fish Division evaluation of the effects of each alternative. The Habitat Units displayed under the Effects of Implementation are valid only if the three assumptions made at the beginning of this section are met. This evalution only covers major areas of impact and not the numerous minor impacts such as bridges, pipeline crossings, increased sediment during and after construction, and other construction related impacts. A table showing the number of Habitat Units which would be lost in each alternative if maintenance flows were not implemented is included at the end of this report. The individual trout Habitat Units listed for each alternative are from Miller (1980). A trout Habitat Unit is defined as the amount of habitat quality required to produce an increase in trout standing crop of one pound per surface acre (Binns, 1976).

3) Number of Streams Diverted - Importance Moderately High

This category attempts to quantify the numerous minor impacts associated with pipeline and road construction, diversion structure installment, and flow regime change which were not quantified in trout Habitat Units. These impacts are quantified simply by the number of streams to be diverted in each alternative which support trout populations.

4) Miles of Stream Habitat Inundated - Moderate Importance

This category quantifies the loss of stream habitat to flat water reservoir habitat in miles of stream inundated. A primary consideration is the loss of naturally reproducing trout stream habitat to reservoir requiring stocking by the Wyoming Game and Fish Department.

5) Fishing Potential - Low Importance

This category quantifies the increase in fishing potential associated with each of the alternatives. Fishing potential is based on the establishment or enlargement of reservoirs and is measured in acres. Streams were not considered because no additional access will be provided in the Douglas Creek drainage and new access into the Little Snake drainage is not

considered beneficial. The status and vulnerability of the Colorado River cutthroat trout may require restrictive regulations or road closure.

# F. Monitoring Criteria

#### 1. Fisheries

- a. Monitoring stations to evaluate any change in species present or population levels need to be established on all streams subject to a change in flow regime. Control stations should be included.
- b. Permanent cross-channel transects need to be established on streams with increased flows to evaluate any effect on the physical characteristics of the stream, channel and fish habitat.
- c. Detailed monitering needs are outlined later in this report.

# Alternative Effects

- A No additional effects or benefits.
- B 7 Colorado River cutthroat streams affected by construction and access associated with diversion in the Little Snake drainage.
  - 2 other trout streams affected by construction and access associated with diversion in the Little Snake drainage.
  - 5.8 miles of trout stream inundated by Hog Park Reservoir.
  - 4 trout streams affected by construction and access associated with diversion in the Douglas Creek drainage.
  - 3.9 miles of trout stream inundated by Rob Roy Reservoir.
  - 520 surface acres added to Hog Park Reservoir.
  - 487 surface acres added to Rob Roy Reservoir.
  - 13 Colorado River cutthroat trout Habitat Units lost in Stage II streams in the Little Snake drainage.
  - 15 brook and cutthroat rainbow hybrid trout Habitat Units lost in Stage II streams in the Little Snake drainage.
  - 121 brook and brown trout Habitat Units lost due to stream inundation by Hog Park Reservoir.
  - 280 brook and brown trout Habitat Units lost due to stream inundation by Rob Roy Reservoir.
  - 18 brook and brown trout Habitat Units lost in Stage II streams in the Douglas Creek drainage.
  - 447 total trout Habitat Units lost.
- C 7 Colorado River cutthroat streams affected by construction and access associated with diversion in the Little Snake drainage.
  - 5.8 miles of trout stream inundated by Hog Park Reservoir.
  - 4 trout streams affected by construction and access associated with diversion in the Douglas Creek drainage.
  - 3.9 miles of stream inundated by Rob Roy Reservoir.
  - 520 surface acres added to Hog Park Reservoir.
  - 487 surface acres added to Rob Roy Reservoir.
  - 13 Colorado River cutthroat trout Habitat Units lost in Stage II streams in the Little Snake drainage.
  - 8 brook and cutthroat rainbow hybrid trout Habitat
    Units lost in Stage II streams in the Little Snake
    drainage.
  - 121 brook and brown trout Habitat Units lost due to stream inundation by Hog Park Reservoir.
  - 280 brook and brown trout Habitat Units lost due to stream inundation by Rob Roy Reservoir.
  - 18 brook and brown trout Habitat Units lost in Stage II streams in the Douglas Creek drainage.
  - 440 total trout Habitat Units lost.

- D 4 trout streams affected by construction and access associated with diversion in the Douglas Creek drainage.
  - 4.9 miles of stream inundated by a lower reservoir in the Little Snake drainage.
  - 5.8 miles of trout stream inundated by Hog Park Reservoir.
  - 3.9 miles of trout stream inundated by Rob Roy Reservoir.
  - 520 surface acres added to Hog Park Reservoir.
  - 487 surface acres added to Rob Roy Reservoir.
  - 400 surface acres of new reservoir in the Little Snake drainage.
  - 121 brook and brown trout Habitat Units lost due to stream inundation by Hog Park Reservoir.
  - 280 brook and brown trout Habitat Units lost due to stream inundation by Rob Roy Reservoir.
  - 451 Colorado River cutthroat trout Habitat Units lost due to stream inundation by a lower reservoir in the little Snake drainage.
  - 220 brook, brown, and rainbow trout Habitat Units lost due to stream inundation by a lower reservoir in the Little Snake drainage.
  - 18 brook and brown trout Habitat Units lost in Stage II streams in the Douglas Creek drainage.
  - 1090 total trout Habitat Units lost.
- E 7 Colorado River cutthroat streams affected by construction and access associated with diversion in the Little Snake drainage.
  - 2 other trout streams affected by construction and access associated with diversion in the Little Snake drainage.
  - 5.8 miles of trout stream inundated by Hog Park Reservoir.
  - 520 surface acres added to Hog Park Reservoir.
  - 13 Colorado River cutthroat trout Habitat Units lost in Stage II streams in the Little Snake drainage.
  - 15 brook and cutthroat rainbow hybrid trout Habitat
    Units lost in Stage II streams in the Little Snake
    drainage.
  - 121 brook and brown trout Habitat Units lost due to stream inundation by Hog Park Reservoir.
  - 149 total trout Habitat Units lost.
- F 7 Colorado River cutthroat streams affected by construction and access associated with diversion in the Little Snake drainage.
  - 2 other trout streams affected by construction and access associated with diversion in the Little Snake drainage.
  - 5.8 miles of trout stream inundated by Hog Park Reservoir.
  - 520 surface acres added to Hog Park Reservoir.

- 13 Colorado River cutthroat trout Habitat Units lost in Stage II streams in the Little Snake drainage.
- 15 brook and cutthroat rainbow hybrid trout Habitat Units lost in Stage II streams in the Little Snake drainage.
- 121 brook and brown trout Habitat Units lost due to stream inundation by Hog Park Reservoir.
- 12,143 brook, brown, and rainbow trout Habitat Units lost in the North Platte River due to direct diversion.
- 12,292 total trout Habitat Units lost.
- G 7 Colorado River cutthroat streams affected by construction and access associated with diversion in the Little Snake drainage.
  - 2 other trout streams affected by construction and access associatied with diversion in the Little Snake drainage.
  - 5.8 miles of trout stream inundated by Hog Park Reservoir.
  - 520 surface acres added to Hog Park Reservoir.
  - 13 Colorado River cutthroat trout Habitat Units lost in Stage II streams in the Little Snake drainage.
  - 15 brook and cutthroat rainbow hybrid trout Habitat Units lost in Stage II streams in the Little Snake drainage.
  - 121 brook and brown trout Habitat Units lost due to stream inundation by Hog Park Reservoir.
  - 12,807 brook, brown, and rainbow trout Habitat Units lost in the North Platte River due to direct diversion.
  - 12,956 total trout Habitat Units lost.

The Stage II pipeline would cross the South Branch of Middle Crow Creek and South Crow Creek on Pole Mountain. These two streams have very little flow or are dry during most of the year and therefore present the opportunity to improve flow conditions and establish a fishery or improve the existing fishery. Gradually adding a controlled amount of water over a number of years would provide an estimated increase of 387 brook trout Habitat Units in the South Branch of Middle Crow Creek on 4.8 miles of MBNF and BLM land (Miller, 1980). It would also provide an estimated increase of 116 brook trout Habitat Units in South Crow Creek on 2.5 miles of MBNF and State land (Miller, 1980). This would provide a total of 503 trout Habitat Units which could be used for mitigation. This would mitigate the major adverse impacts in terms of Habitat Units lost for alternatives B, C, and E. However, Colorado River cutthroat Habitat Units lost would not be mitigated and the value of these must be taken into consideration.

There are three modified release schedules proposed for Hog Park Reservoir (Banner and Associates, 1977). If modified release schedule I or II is implemented, there would be an estimated increase of 378 trout Habitat Units in the Encampment River (Miller, 1980). This would be a benefit but should not be considered mitigation because the Encampment River is presently classified by the Wyoming Game and Fish Department as "Very good trout waters of statewide importance".

Implementation of the recommended Stage I maintenance flows would provide an estimated increase of 259 Colorado River cutthroat trout Habitat Units in the North Fork of the Little Snake River drainage and 559 brook and brown trout Habitat Units in Douglas Creek (Miller, 1980). These Habitat Units would reestablish those lost due to inadequate instream flows since Stage I was completed. Therefore, they should not be considered mitigation.

#### RECOMMENDATIONS

The following recommendations, reported in Jespersen (1979, 1980), should be formally stipulated in the permit authorizing Stage II of the Cheyenne water development project.

1.	Stream	Instream Flow (cfs)	Flushing Flows (cfs)
	Rose Creek	0.75	9.0
	Green Timber Creek	1.0	14.0
	North Fork	2.0	30.0
	Ted Creek	1.0	19.0
	Third Creek	1.0	11.0
	Deadman Creek	2.0	35.0
	Harrison Creek	1.0	9.0
	Solomon Creek	1.0	12.5
	Rab <b>bi</b> t Creek	1.5	18.0
	West Branch	3.5	92.0
	Roaring Fork	1.0	31.5
	Sherard Creek	0.5	12.0
	Douglas Creek	5.5	130.0
	Nugget Gulch Creek	0.2	4.5
	Little Beaver Creek	0.35	7.0
	Camp Creek	0.2	2.0
	Lake Creek	0.5	8.5
	Horse Creek	0.2	0.0

The above recommended instream flows should read "x cubic feet per second, of the natural flow, whichever is less," with the exception of Douglas Creek which is 5.5 cubic feet per second constant flow. All flushing flows are recommended for a 72 hour (3 day) period coinciding with natural peak spring runoff.

### It is also recommended that:

- 2. A blanket minimum flow be maintained on all streams for which a fishery maintenance flow was not recommended. This blanket minimum flow will require that all flow be bypassed starting the first of July until approximately the first week in November or as long as adequate access is still available.
- 3. Either the ten or twelve month modified release schedule be adopted or a pipeline be required from Hog Park Reservoir to the Encampment River.
- 4. No additional flow be added to Middle Crow Creek and that flow added to other streams in the Crow Creek drainage be controllable with a pipeline also going off the Forest.
- 5. Reservoir releases be designed so a discharge determination can be made at the reservoir or immediately below the reservoir.

- 6. Reservoir level management practices which result in extreme flow fluctuations downstream be prohibited. Water which may build up in a reservoir should be released gradually over a period of time which gives aquatic organisms time to adjust. Consult aquatic biologist.
- 7. A Parshall flume or other type of flow measuring weir be installed in each stream containing a fishery that will be or has been affected by this project with the exception of the Encampment and North Platte Rivers.
- 8. If diversion structures are installed in Rabbit Creek, the West Branch, Standard Creek, the Roaring Fork, and/or Sherard Creek, they should be designed to prevent fish from entering the diversion pipeline and to block upstream fish movement without injury.
- 9. All diversion structures not listed under item 8 be designed to prevent fish from entering the diversion pipeline and to allow upstream and downstream fish movement without injury.
- 10. The continued practice of dumping sediment in the stream below the diversion structures be stopped.
- 11. The Stage II collection structures be designed so that the practice of bypassing highly turbid water back into the stream during annual sediment removal can be eliminated.
- 12. Stream banks disturbed during Stage II construction be rip-rapped during construction to keep the addition of sediment to the stream at a minimum. Material used to rip-rap the stream banks should not be taken from the stream bottom of existing stream banks.
- 13. Stream banks and other land disturbed during construction should be revegetated with native vegetation to reestablish natural fish cover and stabilize erosion which will contribute sediment to streams.
- 14. If Stage II is approved, the monitoring program described in detail at the end of this report be implemented as outlined.
- 15. Water samples be collected in the North Fork of the Little Snake River drainage at various levels of natural flow to be analyzed for heavy metal.
- 16. The South Branch of Middle Crow Creek and South Crow Creek be augmented with Stage II water as mitigation for trout Habitat Units lost due to Stage II. Flows added must be controlled to provide a gradual increase which would allow the stream channels time to adjust.

# CHEYENNE WATER PROJECT STAGE II PROPOSED MONITORING PROGRAM

Because Stage II expansion will alter the streamflow in a large number of streams, many recommendations to minimize or mitigate adverse impacts have been made for which extensive monitoring requirements are needed. Several questions have arisen in evaluating the effects of Stage II for which a limited amount of field data and professional opinion provided the basis for making predictions. Generally, previous research dealing with major areas of concern was lacking. Information is needed on the effect of increased and decreased streamflows on channel maintenance, channel stability, aquatic habitat, and fish populations. Monitoring these affects in an actual on-the-ground situation will provide a good basis for making needed recommendations in the future.

An organized data collection program is needed to obtain information for assessing the affects of altered streamflow on the physical and biological characteristics of the stream. Preconstruction baseline data is essential to a monitoring program. Also, the direct effects during and immediately following construction must be monitored for both short and long term effects upon fish habitat and populations.

The following questions need to be considered in establishing a monitoring program for this project.

- 1. How will fish habitat and populations below the proposed diversion structures respond to the change in the natural flow regime?
- 2. How will construction activity affect water quality, fish, and macroinvertebrate habitat and populations? How temporary will these effects be?
- 3. How will increased flows in Hog Park Creek and the Encampment River affect the physical characteristics of the stream, channel stability, fish habitat, and fish population levels?
- 4. How quickly and to what extent will trout populations increase due to improved streamflows below the existing Stage I diversion structures?
- 5. How quickly will stream channels with augmented flow in the Crow Creek drainage stabilize, and how soon will fish populations establish and at what population levels?
- A. Streams Proposed for Diversion in Stage II

Each stream which contains a fishery and is proposed for diversion needs monitoring. Where possible, three population and habitat monitoring stations need to be established on these streams. Two stations should be located below the diversion structure on each stream, one immdediately below but out of the construction zone and the other a half mile or more below. The third station should be established above the diversion to be used as a control if it is possible to establish a station far enough above so that it will not be influenced by the diversion. The effects of the diversion structure on possible spawning migration and other natural fish movement will have to be considered. Fishing pressure will also need to be considered.

These stations need to be established prior to any construction activity with population and habitat data collected to document the existing conditions. Much of this baseline data has already been collected. Review of the study areas outlined in Jespersen (1979, 1980) and Wesche (1974, 1977) will reveal where additional study areas are needed prior to construction.

Additional data may be needed on all streams depending on the time lapse before construction begins.

After construction, these stations need to be monitored annually for a few years as the disturbed channel stabilizes and fish populations adjust to the new flow regime. After this period, monitoring should continue at three to five year intervals to insure maintenance of population levels. Streams containing Colorado River cutthroat trout may need more frequent monitoring to check on the the possible invasion of other species and the affects of increasing fishing pressure.

#### B. Streams Proposed for Augumented Flows in Stage II

Hog Park Creek, the Encampment River, and several streams in the Crow Creek drainage are proposed for augmented flow in Stage II. Various degrees of change in the physical characteristics of the stream are expected to modify fish habitat. The physical characteristics of the stream, associated fish habitat, and population levels need to be monitored on these streams. Three population and habitat stations should be established on each of these streams prior to construction.

Some data has already been collected on Hog Park Creek and the Encampment River as found in the references previously mentioned. In addition, stream channel cross-section transects need to be permanently established on these streams. These will be used to quantify long term changes in the physical characteristics of the stream channel and fish habitat. These transects must be established in adequate numbers and in a systematic method specifically designed for this purpose. Habitat types will shift as the stream channel adjusts to its new flow and transects must be adequate to quantify the overall change in available habitat.

Population data should be collected annually for the first few years and at three to five year intervals following as outlined for the diverted streams. This may vary depending on the degree of change in existing fish habitat noted and the time period required for the stream channel to stabilize. Transect data should be collected annually until the stream has stabilized and then every three to five years as additional population data is collected. Pictures will be of major importance in visually demonstrating the changes that take place.

# C. Stage I Streams

Instream flow recommendations have been made for each of the Stage I streams. Trout populations are expected to increase in response to these recommendations. Population and habitat data have been collected at various distances below the diversions under present conditions. At least two and preferably three population and habitat stations should be monitored below the diversions each year for the first few years and every three to five years following to determine the rate and extent to which the trout population responds to the new flow regime. Additional population data may need to be collected prior to increasing flows depending on the time lapse before the new flows are implemented.

Permanent stream channel cross-section transects have not been established below the diversions. Although these may not be a requirement, data showing the change in the physical characteristics of the stream and fish habitat as flows are increased would be of great value in further demonstrating the need for these flows and how the trout population responds to them.

### D. During Construction

Protective measures are needed during construction to minimize immediate and future damage from erosion. Among these are settling pools, rip-rap, and revegetation to help control the amount of sediment added to the stream system during and after construction. The introduction of large amounts of sediment to the stream system will have immediate adverse affects on fish and macroinvertebrate populations.

Barton (1977) showed a significant drop in trout standing crop with increased suspended solids and sediment deposition due to road construction on a small stream. Trout were believed to have migrated out of the area and macroinvertebrate communities showed reduced numbers of "clean water" species and increased numbers of "polluted water" species. When deposited sediment was flushed by increased flows, trout and macroinvertebrate communities returned to normal in about eight months. Brown and Krygier (1971) report that instream sediment production

doubled after logging roads were constructed but before logging commenced and that bank stabilization, if installed as soon as possible after construction was completed, could have greatly reduced suspended solids resulting from bank erosion.

It is recommended that water quality be monitored above and below the construction zone in the streams to be diverted during construction. Fish and macroinvertebrates should be sampled below the construction zone to monitor the effects of increased sediments on these populations and their recovery rate. Trout may migrate downstream to escape highly turbid water below the construction zone and be unable to return until the following spring runoff provides passage over the many natural fish barriers present in these steep gradient streams during low flow periods. Photos will be important in documenting the type of construction activity, measures taken to minimize impacts, and short and long term affects.

# E. Flow Monitoring

The value of data collected from monitoring the described physical and biological parameters depends on accurate information concerning the flow associated with these parameters. Consistent results cannot be expected if actual flows released are not consistent with those recommended. Because of the large number of streams affected by this project, monitoring streamflow with a current meter is not practical. Therefore, it is recommended that a Parshall flume or other type of flow measuring weir be installed in each stream containing a fishery that will be or has been affected by this project with the exception of the Encampment and North Platte Rivers. This includes Stage I and II streams and streams to be augmented. These devices will greatly improve our ability to ensure that instream flow requirements are being met. They will also be very useful in collection flow data which corresponds to changes in the physical characteristics of the stream, available fish habitat, and population levels.

Comparison of impacts on fish habitat units of the proposed Stage II and its alternatives.

				Major A	Areas of Co	Concern for	Adverse	Impacts t	to Fish		
		Totosiloo I eg	rra Madre Jector System	1	ampment River	110-0-0	яквешеиг Коу Кез.	glas & Lake em	ale Crow Creek	reline	Ĺŧ
Alternatives		Sta	si2 LoD						Mid.		;toT
Stage II	* *		-259 -425	-121	-784			12			_259 _3705
No Action			0								0 0
Stateline Res.	* *			-121	784		-280	-1126	696-	-451 -220	-451 -3500
Modify Stage I	* *		-259 -238	-121	-784		-280	-1126	696-		-259 -3518
Modify Stage II	* *	(+259) (+559)	-13 -15	-121			-280	-18			-13 -434
Hog Park Pumping Alternative	* *		-259 -425	-121					696-		-259 -1515
Boat Creek Pumping Alternative	* *		-259 -425	-121	-784	-12143			696-		-259 -14442
North Gate Pumping Alternative	* *		-259 -425	-121	-784	-12807			696-		-259 -15106

\*Colorado River Cutthroat Trout Habitat Units \*\*Other Trout Habitat Units

- Table is in Trout Habitat Units (HU) as defined by Binns (1977). Note:
- This table was reprinted from the Wyoming Game and Fish Department input and recommendations for Stage II of Cheyenne's water development project provided by W. Donald Dexter March 31, 1980, with the exception of numbers in
- Draft Report, Project 5080-09-6602, Wyoming Game and Fish Dept. ) from Miller, D., 1980. Quantification of Trout Habitat that could be impacted by Stage II of release The "Modified Stage II" alternative is the only alternative in which maintenance flows, a modified the Proposed Cheyenne Water Development Project. Numbers in
  - schedule, and no additional flow in Middle Crow Creek were assumed. 4
    - The Habitat Units in ( ) would reestablish those lost in Stage I streams due to inadequate instream flows since Stage I was completed and therefore are not considered mitigation. 5.

#### REFERENCES CITED

- Banner and Associates, Inc., 1977. Report on Proposed Expansion of Cheyenne's Douglas Creek Facilities. Prepared for the City of Cheyenne, Wyoming, Board of Public Utilities.
- Banner and Associates, Inc., 1979. Supplemental Information on the Cheyenne Stage II Water Supply Expansion for the Draft Environmental Impact Statement. Prepared for the City of Cheyenne, Wyoming, Board of Public Utilities.
- Barton, B.A. 1977. Short-term effects of highway construction on the liminology of a small stream in southern Ontario. Freshwater Biology 7:99-108.
- Binns, N.A., 1977. Evaluation of habitat quality in Wyoming trout streams. Paper presented at the Twelfth Annual Meeting of Colorado-Wyoming Chapter of the American Fisheries Society, March 2, 1977.
- Binns, N.A., 1977. Present Status of Indigenous Populations of Cutthroat Trout, (Salmo clarki), in southwest Wyoming. Fisheries Technical Bulletin No. 2, Wyoming Game and Fish Department.
- Brown, G.W. and Krygier, J.T., 1971. Clear-cut logging and sediment production in the Oregon Coast Range. Water Resource Research, 7, 1189-1198.
- Jespersen, D.M., 1979. Instream Flow Determination and Impact Evaluation of Water Diversion on the Colorado River Cutthrouat Trout and Brook Trout in the North Fork and Roaring Fork on the Little Snake River Drainage, Forest Service Report, Medicine Bow National Forest, Laramie Wyoming, 109 pp.
- Jespersen, D.M., 1980. Instream Flow Determination for Streams Affected by Stage I and II of the City of Cheyenne Water Development Project in the Douglas Creek Drainage and Supplemental Flow Recommendations in the North Fork of the Little Snake River Drainage, Forest Service Report, Medicine Bow National Forest, Laramie, Wyoming.
- Miller, D., 1980. Quantification of Trout Habitat that could be Impacted by Stage II of the Proposed Cheyenne Water Development Project. Draft Report, Project 5080-09-6602, Wyoming Game and Fish Department.
- Stewart, P.T., 1979. Impact Assessment of Augmented Flows Associated with the Proposed Cheyenne Diversion Stage II Development. Medicine Bow National Forest, Laramie, Wyoming.
- Wesche, T.A., 1974. Relationship of Discharge Reductions to Available Trout Habitat for Recommending Suitable Streamflows. Water Resources Series No. 53. Wyoming Water Resources Research Institiue, Laramie, Wyoming.
- Weshe, T.A., 1977. Fishery Resources and Instream Flow Recommendations for Streams to be Impacted by Cheyenne's Proposed Phase II Development Report submitted to Wyoming Game and Fish Department 150 pp.

SOILS CHEYENNE STAGE II STUDY DATA

> Ronald Bauer Jon Nordin Soil Scientists Medicine Bow National Forest



## POSSIBILITY OF SOIL EROSION AND MASS LAND FAILURE

Almost every disturbance of natural soil increases soil erosion. This increase may or may not be significant. Natural soil surface horizons have incorporated organic matter, soil structure, roots, and usually surface litter material. Removal of topsoil increases the potential for soil loss due to the properties of the underlying soil material. The length of continuous slope and slope percent also affect soil loss. In addition, certain seasons (especially spring) contribute the greatest percentage to the total annual erosion.

Most soils and landforms on the Medicine Bow National Forest are not susceptible to high mass movement hazards. The soil materials in general, are stable and slopes are not overly steep. However, about 7% of the areas discussed by all the alternatives are in areas rated with high mass movement hazards. Even though the probability of mass movements are low, the result of such movements are severe. Damage to both the natural resource and any physical improvements is usually high.

Prediction of mass movement hazard requires knowledge and understanding of the relationships of soil, geology, topography, climate, and vegetation. The interactions of these components on the landscape can be interpreted as an indication of stability. Factors contributing to mass movement and features which indicate past mass movements are listed below.

# FACTORS CONTRIBUTING TO MASS MOVEMENT

- -Saturated soil materials; generally late spring following snowmelt or disturbance along side hill seeps and springs.
- -Steep slopes.
- -Fine textured or poorly graded materials (shape and particle size distribution.)
- -Mantle material underlain by incompetent or inprevious materials.
- -Rock type (emphasis on historically unstable formations).
- -Bedrock dipping steeply with the slope.
- -Aspect; more prevalent on north slopes due to the microclimate.
- -Inadequate vegetative cover created by burns or mechanical disturbance.

# FEATURES INDICATING PAST MASS MOVEMENT

- -Hummocky topography.
- -Natural lakes (excluding beaver ponds).
- -Bent trunks and leaning trees (This feature also caused by snow creep).

- -Disorderly sequence of soil materials in a soil profile (mixed horizons).
- -Poorly developed drainage systems accompanied by luxuriant growth of water-loving plants.
- -Downslope strips of old even-age timber paralled to strips of new growth willows, alders, or aspen. (Avalanche paths are very similar.)
- -Crescent shaped scars. (Fresh cracks and bare scarps.)
- -Backward rotated benches and terraces.
- -Linear trenches or depression paralleling slope contours.

When some of the above factors and features are encountered on a landscape a potential for mass movement exists. The degree of this hazard can only be described subjectively.

# SOILS MITIGATION

Exacting mitigation measures would vary with the alternative selected. Detailed plans with precise locations and structural designs of all proposed construction is also needed for accurate determination of needs. All alternatives must comply with the following general mitigation goals.

- -Maintain soil loss below soil loss tolerance levels.
- -Modify cuts and fills, or install bin walls (or similar features) in high mass movement areas.
- -Strip and replace topsoil in identified critical areas, as specified by the Forest Soil Management Specialist, to insure adequate regeneration.
- -Eliminate the hazard of excess sediment from entering streams and water bodies.
- -Return all areas without permanent roads or structures to vegetative production.

# GENERAL DESCRIPTION OF AFFECTED SOILS

An order 3 soil survey (SCS, 1975) was conducted on all Medicine Bow National Forest lands affected by the seven alternatives. The survey was completed on all areas within one-half mile of proposed pipelines and one mile from reservoirs. Requests for additional soil information from the Soil Conservation Service in Wyoming and Colorado were made for alternatives C and E (Lutz, 1979; Suhr, 1979). In addition, input from the Routt National Forest was received for alternative E. The soil input is available for inspection at the Supervisor's Office, Medicine Bow National Forest.

Forty-six different soil mapping units were encountered during the soil survey. Soil parent materials included granite, gneiss, and sandstone residuum; glacial till and outwash; and alluvium. Depth to bedrock ranged from 15 to 45 plus inches per year. Slopes range from 0 to 60 percent.

Elevations range from 7800 to 9800 feet. Soil drainage classes included very poorly, poorly, moderately well, well, and excessively drained. Vegetation present range from alpine meadows to sagebrush. In general, soils and most factors affecting soil development vary over a wide range thoughout the area.

Table V-3 Appendix V lists all the soil mapping units and some basic properties and interpretations. Soil units with slopes greater than 40% were given high mass movement hazards, unless the soil material was very stable. Low regeneration potentials were given to steeply sloping soils and most soils formed in granite residuum. The available moisture for plant growth is given in inches of available moisture in the soil profile. The soil loss tolerance is the acceptable level of annual soil loss, without damaging the resource. The percent ground cover needed to meet the soil loss tolerance at the average slope, indicates how much slash, rock, vegetation, surface letter, or other cover is needed to maintain soil loss below the recommended soil loss tolerance.

The topsoil stripping depth indicates the estimated average depth of suitable topsoil. Most topsoil in areas to be disturbed would not be considered of good quality because of a high percentage of coarse fragments (Rounsaville, 1977).

Most of the soils within the area to be considered are still under natural vegetation and meet the cover requirements to stay below soil loss tolerances. Only existing roads and developments, including Cheyenne's Stage I development, have segments with less soil cover than recommended.

SOILS EVALUATION

PROPOSED

CHEYENNE STAGE II

EXPANSION

(Alternative Plan D Little Snake Reservoir)



The following soils and geotechnical evaluations were made using the Order 3 soil survey made in the summer of 1979 and the Geologic Map of Carbon County, Wyoming, J.L. Weitz and J.D. Love 1952. The soils map is at a scale of 1:24,000 and the geologic map is at a scale of 1:158,400.

Soils. There are six soil mapping units which are slope phases of two soil associations, 1006 and 1012. The soil properties and interpretations for these units are given in the table submitted by John Nordin.

Geology. There are two geologic mapping units on the lower reservoir site, pre-Cambrian undivided and Browns Park formation. The pre-Cambrian are competent igneous and metamorphic rocks. The Browns Park formation is a white massive soft tuffaceous sandstone and white marl underlain by conglomerate. At the proposed site the Browns Park overlays the pre-Cambrian.

Evaluation. Of utmost concern to construction of a dam and reservoir is stability or mass movement hazard. Soil mapping unit 1006D is rated high and 1012C is rated moderated for mass movement hazard. The Browns Park formation is weakly indurated and poorly graded. These two qualities make it undesirable, both as a construction material and as the the adjacent bedrock. The pre-Cambrian material should be satisfactory as as bedrock material for a dam.

Although complete intensive geotechnical investigations would be required prior to design and construction of a dam, the above evaluations of existing data indicates there are potential serious hazards present.

RONALD F. BAUER Soil & Water Staff Soil Scientist

WILDLIFE CHEYENNE STAGE II STUDY DATA

William Blunt
Wildlife Biologist
Medicine Bow
National Forest

P MOTTONS

WITDLIETS CHEYENED STAGE IT STITE DATA

uifi — Binni —

Wifi — A Piul giar

William I a Reise 

Wifi — Linka The

Wifi — Charles 

Wifi — Charles

BASILIA

Unit Final Environmental Statement, transmitted to C.E.Q. September 29, 1977, under Biological Setting, Flora and Fauna and Resource Descriptions, Wildlife and Fish Habitat. (Copy available in Medicine Bow Forest Supervisor's Office).

Threatened and Endangered Species

- 1. Aquatic
- 2. Terrestrial
- 3. Plants
- 4. Reference to biological assessment

All of the above items are discussed in the Biological Assessment on Listed Threatened or Endangered Species.

#### A. Criteria

- 1. a. Watershed
  - Vegetative species altered (by flow fluctuations) acres.

Any alternative which would require increasing the dam heights at Hog Park and Rob Roy reservoirs would result in a decrease of 1007 acres of terrestrial habitat.

- b. Fisheries Dennis Jespersen
  - 1). Species present number of species
  - 2). Population potential lbs per acre (by species)
  - 3). Fishing user days
- c. Terristrial Wildlife
  - 1). Species present number of species

Over 25 species of mammals including three big game species, 30 species of birds and one upland game bird species (blue grouse) and two species of small game (rabbits and squirrels). Wild turkeys have reportedly been observed at lower elevations.

a). Indicator species

E1k

2). Diversity of Habitat

Elevation ranges from 7,250 to 10,561 feet. Located at the highest elevations are subalpine and alpine meadows with many species of alpine forbs and grasses. Engelmann spruce and subalpine fir stands occupy the next to highest elevation sites with lodgepole pine occurring at middle elevations. Aspen is generally found at lower elevations on south and west exposures. These forested types are interspersed with aspen-grass parks and wet meadows. The lower elevations are foothill areas with oakbrush, serviceberry, and dry grasslands. (Huston Park Unit Final Environmental Statement).

 Consumptive and nonconsumptive use - Wildlife & Fish use days.

Fishing use days as well as wildlife are limited by the lack of access. Total use days are estimated to be about 1200 with most of these being generated by big game hunters.

- d. Threatened and Endangered Species
  - 1). Species present-name of species
  - 2). See the Biological Assessment on Listed or Proposed Threatened or Endangered Species
- 2. How well does each alternative resolve public issues.
  - a. Unique species habitat

Colorado cutthroat trout

Instream flows as well as flushing flows will be established for all perennial streams. (See Increased and Decreased Stream Flows) Alternative C, D, E.

b. Threatened and Endangered Species

None of the alternatives will significantly affect any of the listed species.

### B. Affected Environment

- 1. Watershed Appendix VIII Section 1.
  - a. Vegetative species altered by flow fluctuation. No vegetative species changes are anticipated as a result of diverting water since instream flows will be established for all perennial streams.
- 2. Fisheries Appendix VIII Section 2.
  - a. Historical Fishery
    - 1). Species
    - 2). Population levels
  - b. Existing Threatened or Endangered Species
    - 1). Listed Endangered Species

Gila cypha humpback chub
Ptychocheilus lucius Colorado squawfish

Proposed Species

Gila elegans bonytail chub
Xyrauchen texanus razorback sucker

2). Location

Yampa River below the confluence of the Little Snake. This is approximately  $100\ \mathrm{miles}\ \mathrm{downstream}$  from the project area.

3). Probable Effect

It is the opinion of the Forest Service that Stage II of the Cheyenne Water Project will not significantly affect any of the listed species.

- 3. Terrestrial Wildlife
  - a. Existing Species
  - b. Habitats

Existing conditions (Flora and Fauna) for the Little Snake River project area are covered in the Huston Park Land Management Plan.

#### C. Introduction

- 1. Listing of Issues
  - a. Unique Species Habitat Colorado River cutthroat trout
  - Threatened and Endangered Species (Listed)
     Colorado squawfish
     Humpback chub

## 2. Management Concerns

a. Vegetative species changes - No vegetative species changes are anticipatied as a result of diverting water since instream flows will be established for all perennial streams.

There will be a change in vegetation along pipeline right-of-ways. This will be a successional change, in most cases, resulting in similar vegetation returning to the area over a period of years.

- b. Effects on Fisheries Appendix VIII Section 2.
- c. Effect on Terrestrial Wildlife There may be some movement (translocation) of elk during the construction period. That is, the construction activity may cause elk using the immediate vicinity to move to an adjacent area.
- 3. Purpose & Need for Response
  - a. Mitigation needed Minimum flow by stream (including Douglas Creek).

Flushing flow by stream

Annual payback system

Separate bag limit for cutthroat trout

b. Threatened & Endangered Species

Threatened and/or endangered species are discussed in the Biological Assessment on Listed or Proposed Threatened or Endangered Species - Cheyenne Water Supply Project transmitted to the Fish and Wildlife Service on August 31, 1979. (Copy available in Medicine Bow Forest Supervisor's Office).

- 4. Alternate Formulation Criteria
  - a. Must consider needed instream flows for National Forest uses.
  - b. Must consider needs for T&E species

None of the alternatives will significantly affect any of the listed species - See Biological Assessment on Listed or Proposed Threatened or Endangered Species.

c. Must consider Huston Park Land Management Plan.

Maintain summer range habitat for big game at existing levels.

Maintain upland bird habitat at existing levels.

Maintain trout habitat in all streams where fisheries now exist with emphasis on maintaining the habitat of Colorado River cutthroat trout where it now exists.

Maintain small animal and bird habitat which will produce an abundance and diversity of native species.

5. Analysis Criteria

(See each alternative)

- 6. Monitoring Criteria
  - a. Instream flows -Appendix VIII Sections 1 & 2.
  - b. Fisheries Appendix VIII Section 2.

### D. Alternatives Considered

- A-This alternative eliminates the possibility of the construction of access roads which could be used to manage big game and small game species.
- B-This alternative would be the most detrimental to wildlife habitat since it would involve construction of a new reservoir, access roads, and other facilities in the aspen-shrub type. This type is used as spring-fall big game range.
- C-This alternative would impact fewer streams than alternative D but reduce the opportunity for a wildlife management access road. Approximately 1,007 acres of habitat lost due to enlargement of Hog Park & Rob Roy reservoirs.
- D-This alternative would offer the opportunity to obtain access which would be helpful in management of elk as well as deer and upland game. Approximately 1,007 acres of habitat lost due to enlargement of Hog Park & Rob Roy reservoirs.

E-Same comments as D.

F-Same comments as D.

G-This alternative would offer the same opportunity for access as D. Approximately 520 acres of habitat would be lost due to enlargement of Hog Park reservoir.

# HABITAT INUNDATED

# Hog Park Reservoir

Vegetation Type	Approximate Additional Acres Inundated
Willow Grass Conifer	$   \begin{array}{r}     10 \\     328 \\     \underline{182} \\     520   \end{array} $
Ro	b Roy Reservoir
Willow Grass Conifer	180 27 <u>280</u> 487

LANDSCAPE MANAGEMENT CHEYENNE STAGE II STUDY DATA

> Christopher Marvel Landscape Archetect Medicine Bow National Forest

TYSTERNA READERNA PRATE SEMENERO ATAU VERTE

Ligated spirits and discount of the control of the

## A. EFFECT ON THE VISUAL RESOURCE

The effect on the Visual Resource from project alternatives will range from no effect to adverse. The design alternatives were chosen with respect to engineering considerations. The constraints that developed from the design of a gravity feed water system fixed the system's location on the landscape. Normally linear design projects would be located to minimize the impact on the visual resource, which, in this case, is not possible. Therefore, all alternatives will have some negative effect on the aesthetics of the landscape due in whole to the rigid requirements of the engineering design.

# B. EXISTING VISUAL RESOURCE

The existing visual resource ranges from outstanding to common in aesthetic quality. For detailed information on the existing visual resource see the appendix. The report in the appendix describes and lists the existing Visual Quality objectives and Visual Absorbtion Capability for all areas affected by the project alternatives.

# C. OUTSTANDING VISUAL RESOURCE

Hog Park has all the ingredients of an outstanding visual resource. The combination of open meadow and conifer coupled with the flat mirror plane of water reflecting the scenic mountains in the background provides contrast and variety of a high aesthetic quality.

The area from the West Branch to Deadline Creek just below the Huston Park Wilderness is outstanding. The meadow, parks, vegetation, and rock outcrop provide a unique combination of variety. Light patterns produced by the diverse aspen/conifer forest and fern groundcover make the walk through this mountain terrain an outstanding visual experience. Pictures of this area are enclosed in the appendix.

### D. STATE LAND USE PLAN

State plans do not evaluate the visual resource in analytical terms.

"State of Wyoming Goals & Policy - Utility Corridors 217.1 Policy - The construction of transmission facilities, highways, railroads, pipelines, . . . . . constructed in an orderly manner compatible to the maximum extent possible with existing environmental, economic, and land use conditions."

The siphon system proposed in some of the project alternatives is <u>not</u> compatible with the environmental conditions (visual resource) and therefore not consistent with the State of Wyoming Land Use Plan. (Siphons have since been eliminated from the proposal).

Recommendation on Utility Corridor, Pg. 85. "Highway through forested lands should be designed to minimize to the maximum extent possible impact on these lands and road standards should be limited to the minimum width necessary for management and safety."

Pipeline and road corridors which cut across sheer rock outcrop formations do not meet the intent of either the policy statement or item 3 under recommendations for utility corridors.

# E. EVALUATING ALTERNATIVES

It has been assumed that the dewatering of large segments of stream environment will not be permitted. The high aesthetic quality of water, especially moving water in dry climates, has long been recognized as an aesthetic attribute. Any elimination of natural stream environments through dewatering will have an extremely detrimental effect on the visual resource.

It is assumed that streams dewatered under Stage I will be restored to a minimum flow condition under Stage II insuring the future integrity of the aesthetics of these National Forest Lands.

#### F. MITIGATION

Mitigation for the visual resource will be the same for all alternatives. The following are mitigation recommendations which will lessen the effects on the visual resource.

## Activity Mitigation

Pipes & Roads Revegetation of all cut slopes, fill slopes, and other disturbed areas is

recommended to minimize line contrast between soil and existing vegetation.

## F. UNMITIGABLE EFFECTS

For all alternatives, siphon systems in forested areas, as shown, are placed with little regard for their effect on the visual resource. In areas with a visual quality objective of Retention or Partial Retention these structures, as proposed, do not meet the stated objective and are unacceptable modification. It will be extremely difficult if not impossible to mitigate the effects of a siphon system because of engineering design constraints. They are, therefore, unmitigable in areas of Retention and Partial Retention. (These siphons have since been eliminated from the proposal).

TRANSPORTATION
CHEYENNE STAGE II
STUDY DATA

John T. Chesley Civil Engineer Medicine Bow National Forest

3 NOT TO U.S.

CHENTROS CHENTROS CE CHENTROS CHENTROS CE COURT DATA

Tons I Conding Civil Englisher Section Now Mattend Fornst

0.9-1

#### A. ACCESS

New access into unroaded areas - varies from 15 miles to 30 miles depending on the alternative chosen. A new access into any unroaded area impacts resource and program objectives.

- -More roads are needed to effect more dispersed recreation and hunting opportunities south of the Huston Park area.
- -Access into the Snake River drainage could increase fishing pressure on the Colorado cutthroat trout.
- -Access into Rose Creek should enable management of timber in the Green Timber Creek drainage.
- -New roads should not be built to too high a standard because it creates more land disturbance than is required to provide adequate, safe transportation.
- -An extention of FDR 809 could become the first link of a road connecting the eastern half of the South Hayden District with the western half.
- -The Hog Park Road (FDR 550) needs an improved running surface before handling any increased traffic.
- -New access into the Lake Creek and Hay Creek drainages serves no purpose in the Forest management and should be built to minimum standards required by Cheyenne and gated.

#### B. TRANSPORTATION

1. Road System Planning - Portion of South Hayden Transportation Plan

A road following the proposed pipeline route into the Snake River drainage area or one following the proposed route to the North Fork of the Little Snake Pump Station would not be included in a Forest Transportation Plan unless built by the City of Cheyenne for the purpose of obtaining needed water. The remaining resources in this section of the Hayden District could not economically support a road system following these routes.

The management direction of the areas served by either of these routes would shift from one of a primitive recreation

experience interrupted by occasional 4-wheel drive traffic to an area with dispersed recreation served by roads and more intensive management of timber, wildlife, fire, and range, with eventual through traffic to the eastern half of the Hayden District.

The most adverse effects on the environment would be along the road corridor during construction, with the temporary pollution of noise, air, and water. This would be most objectionable along the southern border of the Huston Park roadless area where management is directed toward a primitive recreational experience. After construction, there will be the problems of visual quality, dust and noise from traffic, and errosion from cut and fill slopes. The first three problems, combined with increased use, will affect the Huston Park roadless area along a one mile corridor of the proposed road.

#### 2. Facilities in Place

There could be increased use throughout the transportation system serving the Hog Park Reservoir and Rob Roy Reservoir unless the increase in gas prices and shortages reduce recreational travel. An increase of even 50% on existing roads could have little effect on the environment.

There is a problem of access to the Rob Roy Reservoir area until late spring due to large snow drifts. This problem could be compounded unless proposed roads are designed to avoid snow accumulation zones.

## C. MANAGEMENT CONCERNS

### 1. Effects on Recreation

Trail System - Each alternative, except Alternate A, will have some impact on the Forest Trail system, with Alternate D impacting the System the least, Alternate C next, and Alternate B, E, and G the most. This impact will be an increase in trail use, contributing to an increase in dispersed recreation and the greater the impact, the more beneficial is the alternative.

The trail system is used primarily during hunting season.

## D. TRANSPORTATION SYSTEM

In order for a transportation system alternative to be considered for implementation, it will be expected to conform with previously established management direction, (agency policies, public laws, and existing management plans), as well as address the specific project issues identified in Section IV.c.7. A summary of the road system data used to help develop criteria is listed in Section 4.

- 1. Multiple Use Plan selected references
  - a. Crest Zone
    - 1) Road cuts and fills sloped at least 2:1 and seeded the year of construction.
    - 2) Borrow pits, stockpiles, and quarries prohibited.
  - b. I-5 Zone view area from reservoirs
    - 1) Screen roads from view.
    - 2) Control ORV traffic with signs.
    - 3) Blend timber cutting with surroundings.
    - 4) Surface all roads.
    - 5) Avoid utility lines.
  - c. Travel Influence Zone
    - 1) Provide roadside stops and point-of-interest parking.
    - 2) Borrow pits and slash disposal out-of-site.
  - d. Water Influence Zone
    - 1) All roads to be graveled as soon as possible. Gravel all new roads.
    - 2) No borrow pits except at previously used sites.

#### e. All Zones

- 1) R/W clearing will be cut to give a feathered appearance.
- 2) Where possible, leave a cover of saplings and poles in R/W clearing.
- 3) Save borrow pit topsoil for revegetation.

## 2. Huston Park Unit Plan

- a. Unit I: Wilderness Management.
- b. Unit II: Emphasis on dispersed recreation with motor vehicles allowed subject to seasonal closures. Timber harvest permitted in support of other uses.
- c. Unit III: Emphasis on dispersed recreation with timber harvest permitted in support of other uses.
- d. Unit IIa and IIIa: Subject to some limitations as applied to Units II and III, respectively.
- e. Unit IV: If Cheyenne project is carried out, management will be the same as for Unit II.
- 3. Evaluation criteria specific to the project.

The following criteria is based on the assumption that all roads are built to Forest Service standards and may be closed or seasonally restricted to off road vehicle use to protect against resource damage or conflict of use.

- a. Timber management: The importance factor is high because of the increased traffic generated from timber sales and the monetary value placed on timber harvest.
- b. Dispersed Recreation: The importance factor is moderately high to emphasize the management goals in those zones where new access into roadless areas is planned.
- c. Provide a primary section of an East-West travel route: The importance is rated Moderate. Although not essential, an East-West route would cut travel time and operation costs for administration of the South Hayden District.

- d. Land Disturbance: The importance is rated moderately high. Although land disturbance will be kept at a minimum, there are sections of road planned through areas of steep sideslopes and rock outcrops. These sections of road will be less aesthetically pleasing after construction and will also present increased noise, dust, and erosion pollution during construction than is normally present on low standard forest roads.
- 4. How well does each alternative meet state and county plans? There is no apparent conflict with state or county plans and the proposed road system.
- 5. Huston Park: Certain areas including the corridor for the proposed Continental Divide Trail may be closed or seasonally restricted to off-road vehicle use to protect against resource damage or conflict of use.

# F. MONITORING CRITERIA RECOMMENDATIONS

- Design Stage: All road locations should be flagged in the field and approved by the Forest Service Engineer before road designs are completed. All road designs should be reviewed and approved by the Engineer to check compliance with Forest Service standards and permit requirements.
- 2. Construction Stage: Inspection during road construction to ensure compliance with the permit requirements, shown on the approved drawings and specifications, shall be performed by Forest Service personnel. This does not relieve Cheyenne of inspection duties for quality control but is a check for Forest Service use only.
- 3. Maintenance Stage: Field inspection of all roads not placed on the Forest system shall be performed each year to ensure that no environmental damage is occurring on these roads due to a lack of maintenance by the City of Cheyenne.

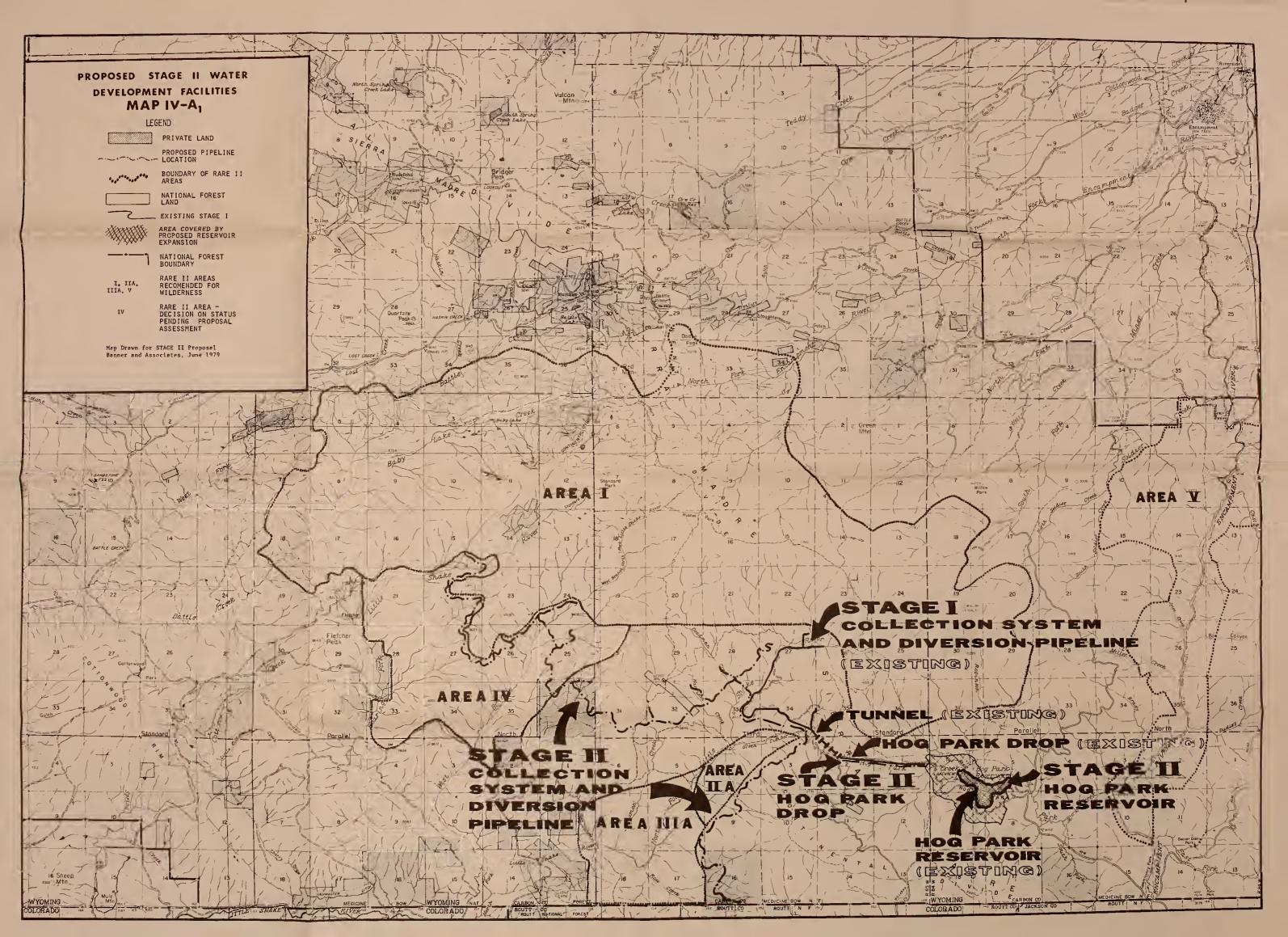
















R0000 105119

